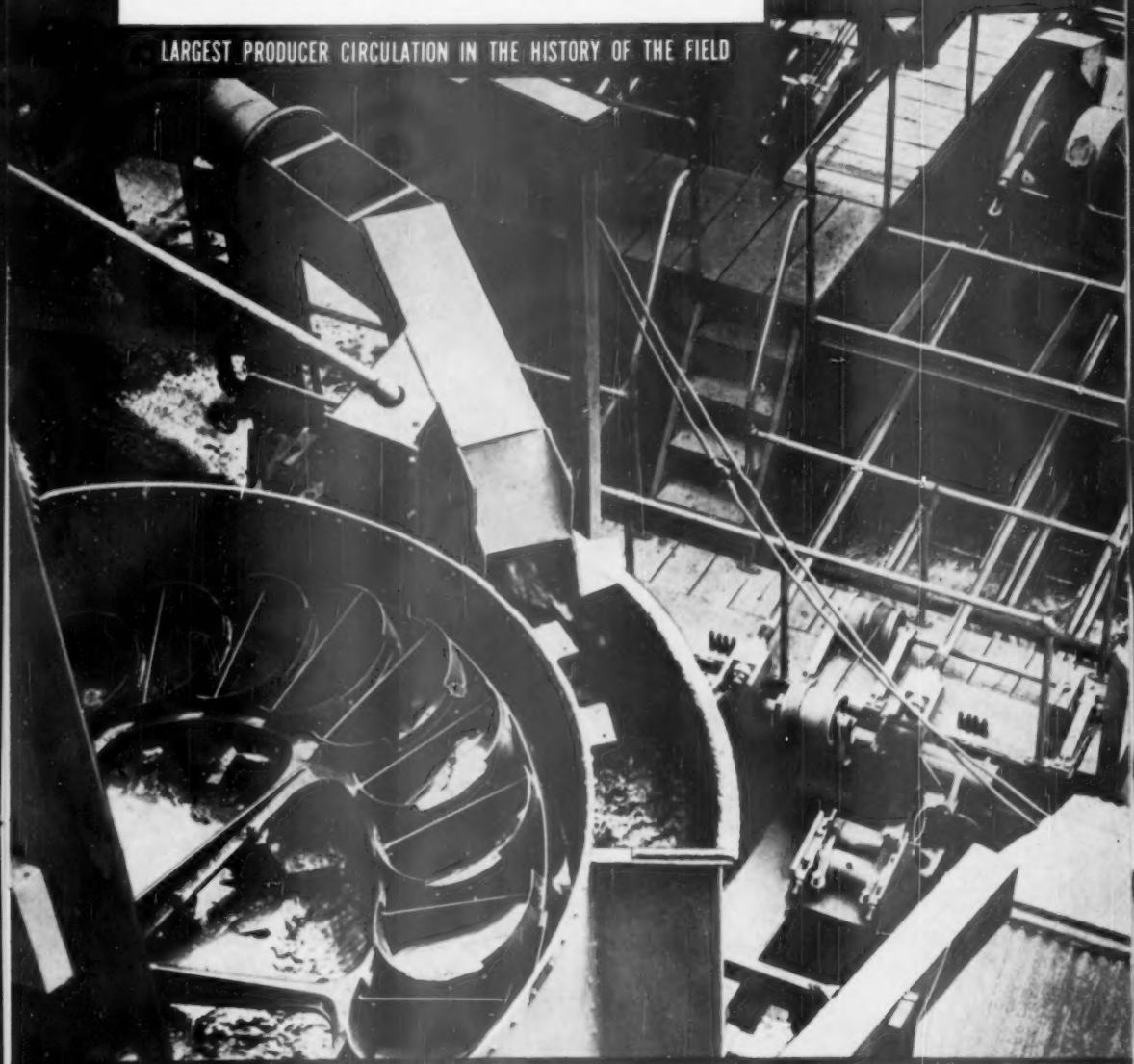


THE INDUSTRY'S RECOGNIZED AUTHORITY

# ROCK PRODUCTS

LARGEST PRODUCER CIRCULATION IN THE HISTORY OF THE FIELD



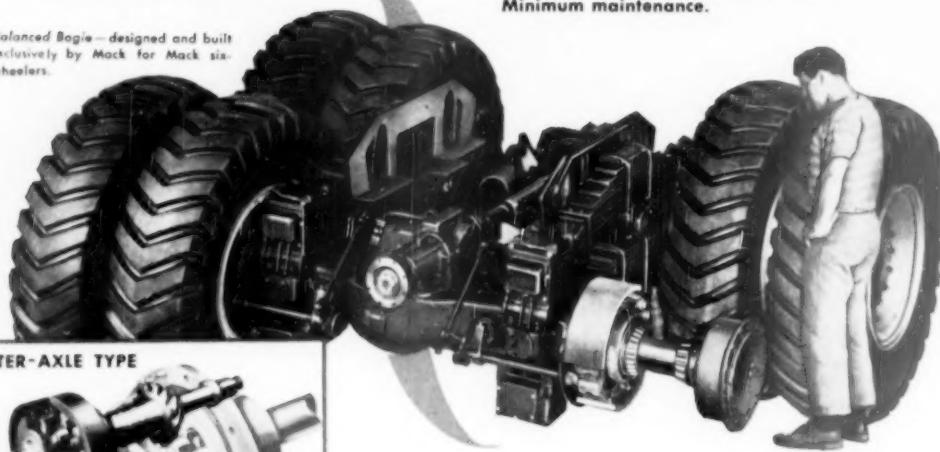
# Profit by these advantages!

## exclusive with Mack Six-Wheelers

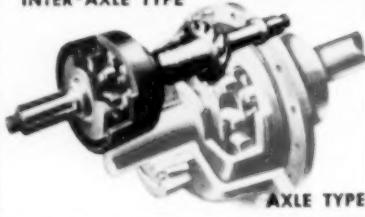
A Mack six-wheeler on your hauling job brings you profit-building advantages offered by no other make of truck — advantages that mean outstanding performance and economy.

### Mack BALANCED BOGIE

Balanced Bogie — designed and built exclusively by Mack for Mack six-wheelers.



INTER-AXLE TYPE



AXLE TYPE

Mack Power Divider — exclusive in the Mack Balanced Bogie.

IT'S PART OF THE LANGUAGE

Built Like a **Mack** Truck™

For full information on Mack's Balanced Bogie and exclusive Power Divider — what they can mean to you in trouble-free, uninterrupted schedules; in lower costs and increased profits — see your nearest Mack branch or dealer.



Photo courtesy Inland Kimpire Paper Co.

## Rubber helps put the squeeze on paper

*A typical example of B. F. Goodrich product improvement*

GOING down that line is next month's newspaper: those big rolls are squeezing the last water out of pulp—off the last roll will come dry, finished paper.

But the leather belt that had been used to drive those heavy rolls had to be so tight that it soon stretched and wore out. Then the whole mill would shut down while the belt was repaired or replaced. An ordinary rubber belt wouldn't do because the pull on the belt was so great the metal fasteners, used for joining the belt ends, would tear out.

But B. F. Goodrich had developed a belt so strong it rarely stretches and then invented a method of locking belt ends together with a splice which never tears loose. Where ends of the outside plies come together they are carried down under the surface, protected by a flexible top layer and vulcanized with new rubber. This splice actually ends 90% of all belt troubles.

A B. F. Goodrich rubber belt, made endless by this Plylock Splice, as it is called, was put on the big mill in the picture; it has already outlasted leather 3 to 1.

The Plylock Splice illustrates the B. F. Goodrich policy of constantly improving the value to the customer of everything made of rubber—for-industry. Research here never stops; nothing is ever "good enough"; improvement must be constant. Some people might call it improving ourselves out of business; we call it the American competitive profit system at work. *The B. F. Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

**B.F. Goodrich**  
RUBBER FOR INDUSTRY .



FEBRUARY, 1950

# ROCK PRODUCTS

THE INDUSTRY'S RECOGNIZED AUTHORITY



VOL. 53, No. 2

**Bror Nordberg**  
Editor

**Nathan C. Rockwood**  
Editorial Consultant

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*Twin telescopic hoists raise the body for dumping. The side door opens automatically, shedding the load clear of the tires; closes automatically as the body is lowered.*



*45-ton capacity double bottom drop door side-dump hauls cement rock at Marquette Cement Manufacturing Company's Oglesby (Illinois) plant.*

## A great new drop door **SIDE-DUMP** *by EASTON*

**Here it is** — another great EASTON drop door side-dump (truck body or trailer) for versatile off-highway hauling. Featuring the patented EASTON automatic drop door, controlled by an amazingly smooth and sturdy leverage system. Choose hydraulic dumping, or dumping by EASTON automatic overhead hoist. Choose any make of truck or truck-tractor. And get on the straight road to big savings with EASTON engineered side-dump haulage. You are invited to send for complete information.



**EASTON**  
*Side-Dump*

TRAILERS • TRUCK BODIES

BUILT BY THE MAKERS OF EASTON MINE AND QUARRY CARS

EASTON CAR & CONSTRUCTION COMPANY OF EASTON, PA.

© 1957

# New TIMKEN® "Spiralock" rock bit offers more advantages than any other one-use bit!



**2 EASIER TO GET ON AND OFF.** A few blows of the drill and it's on. A few blows of a hammer and it's off. Smooth socket contours assure easy detachability.

**3 MADE OF TIMKEN ELECTRIC FURNACE STEEL.** Fast cutting. Long lasting. Has high resistance to wear and abrasion and the toughness to withstand constant pounding. Uniform quality.

**4 NON-RIFLING.** The "X" cutting edge prevents rifling in any ground.

**5 CROWNED CHISEL PILOT.** Easier starting and clearing.

**6 SIMPLIFIES PREPARATION OF DRILL STEELS.** Due to "Spiralock" union, steels last much longer, are easier to prepare and recondition. Square steel ends simplify rifling. They may be machined or forged.

**7 ANY STEELS CAN BE USED.** Existing drill steels of any size and section can be easily and quickly adapted.

**1 STAYS ON MORE DEPENDABLY.** New "Spiralock" union—formed by square socket that spirals slightly as it recedes—has proved superior under actual on-the-job conditions.

PATENT PENDING



ALL these advantages of the Timken® one-use "Spiralock" rock bit have been proved under actual on-the-job conditions. They are unequalled by any other one-use rock bit.

This revolutionary new bit is designed for drilling jobs where bit reconditioning is impractical or undesirable. It is available in a variety of types and sizes.

The one-use "Spiralock" bit is the latest addition to the famous Timken rock bit line, which includes the widely-used Timken threaded carbide insert and multi-use bits. Remember, Timken is the *only* company that offers you *all* three types.

For help in choosing the right bit for your particular job, use the 17-year experience of our Rock Bit Engineering Service. Write to The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

## TIMKEN

TRADE MARK REG. U. S. PAT. OFF.  
YOUR BEST BET FOR THE BEST BIT  
...FOR EVERY JOB



1 Timken threaded multi-use rock bit.



2 Timken threaded carbide insert rock bit.



3 Timken one-use "Spiralock" rock bit.



# *Ease of Control means MONEY!*

This is all there is to the "Feather-Touch" Clutch Control. No valves or tubing. Nothing affected by temperature. Nothing to refill.

Easy control means faster operation and higher output per unit of time and it means a higher output curve as the day progresses because it reduces cumulative fatigue.

The Northwest brings you the "Feather-Touch" Clutch Control — a simple mechanical device that throws heavy drum clutches through the power of the engine. There are no pipes, no pumps, no valves and nothing to refill. It is not subject to influence by weather or temperature. It brings the operator the "feel of the load" at all times. Release is positive and your machine cannot be shut down by control failure.

In conjunction with the Northwest Dual Independent Crowd, that utilizes force other independent crowd shovels waste, it makes the rock jobs easier and assures greater output.

It is just another of the many Northwest advantages that make the Northwest a real Rock Shovel. You can't afford anything but the best for the Key Spots at the heart of the job. You should know about Northwest advantages. Ask for details and plan ahead. Why not place your order and be sure of a real Rock Shovel?

**NORTHWEST ENGINEERING CO.**  
1514 Field Building, 135 South LaSalle Street, Chicago 3, Illinois



# **NORTHWEST**



You'll move more ROCK for your money,  
over the years, with a . . . .

# MARION 4161



Sixty-five years have taught us what it takes to build REAL shovels . . . how to build qualities into them that don't meet the eye but are eloquent in terms of performance and dependability.

These extra qualities are MORE than worth every penny they cost.

THE MARION 4161 has made an impressive name over the years . . . one company owns 26 of these machines . . . and another has 25!

MARION is proud of the 4161 and its record . . . and stands behind this and every other machine that bears the MARION name.

We build good shovels and we back up every MARION owner only for one reason . . . it's the best way to give you more for your money . . . both for today and over the years.

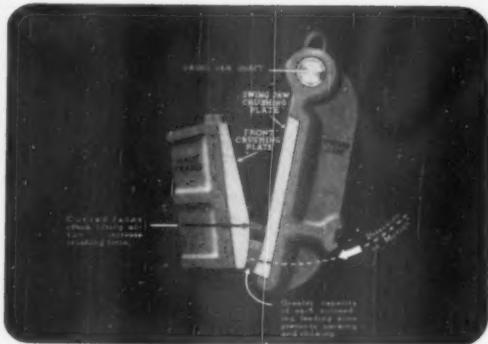
**MARION** POWER SHOVEL CO.  
MARION, OHIO, U. S. A.

OFFICES AND WAREHOUSES IN ALL PRINCIPAL CITIES

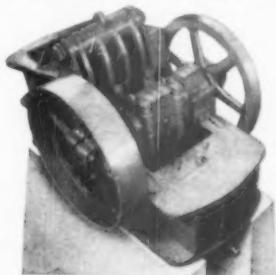


from 260 cu. yds.  
to 45 cu. yds.

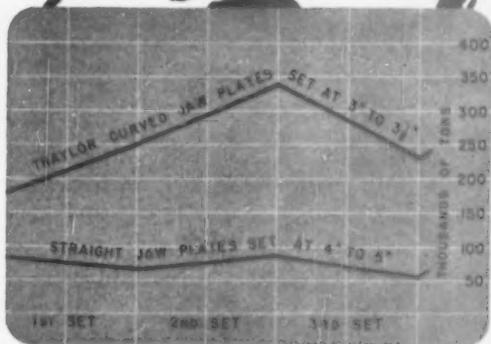
# What do I Know about crushing



**Plenty Mister!** See those curved jaws of mine! When something gets between them it doesn't slip—it gets crushed! Nature curved my jaws to use every bit of strength for direct crushing. Traylor curved jaw plates use this same principle to attain outstanding performance.



Only Traylor smooth-face curved jaw plates, in a Traylor Jaw Crusher, like this Model HB, or fitted to your present equipment can give you this profitable performance. Traylor makes other jaw crushers, from 8" x 12" to 66" x 86", the largest and strongest in the world.



For instance, records kept on a 36" x 48" crusher at a setting of 4" to 5" show the average life of straight jaw plates to be 96,500 tons per set. Traylor smooth-face curved jaw plates fitted to this crusher and set at 3" to 3 1/2" averaged 276,724 tons.



Write today for Bulletin 3105. It gives full details of the Traylor Model H and HB Jaw Crushers and clearly explains the operating principle of Traylor non-chokable, smooth-face curved jaw plates.

# Traylor

Rotary Kilns, Coolers and Dryers  
Grinding Mills • Crushing Rolls  
Jaw, Reduction and Gyrotary Crushers

TRAYLOR ENGINEERING & MANUFACTURING CO.  
116 Mill St., Allentown, Pa.

Sales Offices: New York, N. Y., Chicago, Ill., Los Angeles, Calif.  
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P. Q.

A "TRAYLOR" LEADS TO GREATER PROFITS

## RECOMMENDED OR APPROVED BY 111



**Socony-Vacuum Representatives** who work with your maintenance men call on 84 years of experience to assure the most effective lubrication program for your particular operation.



ENGINE AND EQUIPMENT BUILDERS—

# DELVAC OILS

**Reduce Downtime • Speed Work • Cut Costs!**

**These famous heavy-duty oils for gasoline and Diesel engines give proved performance under toughest conditions . . .**



#### ...Keep Engines Clean

Delvac "Series 900" Oils have exceptional resistance to oxidation, are detergent and dispersive. They minimize formation of lacquer and other harmful deposits—hold contaminants in suspension until drained at regular periods. Your engines stay cleaner and run better.



#### ...Assure Full Power

Delvac "Series 900" Oils assure proper ring seal, guard against blow-by. This means more efficient compression and combustion . . . full, dependable power output . . . maximum fuel economy. Your machines do more work in less time, cost less to run—even under toughest conditions!



#### ...Protect Against Wear

Delvac "Series 900" Oils are made from specially selected, solvent-refined base stocks that provide ample "body" under the high temperatures of heavy-duty service. Their rich lubricating films give rings, pistons, cylinders, bearings—all vital parts—full protection against wear.



#### ...Prolong Bearing Life

Delvac "Series 900" Oils have high chemical stability, help protect hard alloy bearings against corrosion and wear. Bearing shown—photographed after 160,000 miles of service—is still good for thousands of miles . . . proof that Delvac Oils prolong bearing life.

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

## SOCONY-VACUUM

*Contractors' Service*

**Keeps machines on the job...  
Speeds work progress!**



This **Continental**  
**CONVEYOR**  
does  
**"Double Duty"**



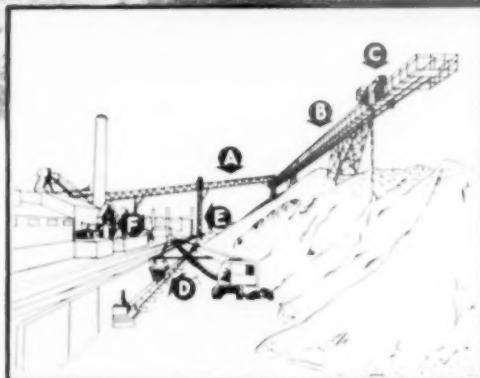
**Another Example of Continental's  
Belt Conveyors at Work -**

The Southern Cement Company's conveying and elevating system in their Birmingham Plant incorporates several advanced features of design—one of which is illustrated above and to the right.

Continental's engineers are skilled in "practical engineering" — the kind that results in installations designed for economical, dependable operation and long life. All Continental products — whether especially designed systems and equipment or standard equipment and accessories — show the value of practical engineering.

- Call Continental engineers in on your job — or specify Continental on your next replacement order.

Write for your copy of Continental's new Catalog ID 481, "Continental Belt Conveyors."



Slag is carried to storage by Conveyors A and B and discharged to storage at any point by self-propelled Tripper, C. As material is needed for processing, it is loaded by shovel onto Reclaim Conveyor D, raised by Bucket Elevator E, and discharged onto return side of Conveyor Belt A., which delivers it to Plant F.

**INDUSTRIAL DIVISION  
CONTINENTAL GIN COMPANY**

BIRMINGHAM, ALABAMA

ENGINEERS



ATLANTA

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MEMPHIS



MANUFACTURERS



# *judgment*

*snap judgment* can pay off . . . but usually it's an expensive luxury. When considering a better looking and more efficient container for your product, we know you'll want to give this SALES STIMULATING subject a long, hard look. Your Chase Salesman is thoroughly qualified to analyze your requirements. He is supported by engineering, design, and research data that can be quickly brought to bear on your specific problem. Why not make it a point to check with him today?



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bags for all  
industry and  
agriculture...

- cotton bags of all kinds
- Topmill burlap bags
- paper & Multiwall bags
- Saxolin open mesh bags
- combination bags, liners, and specialties.

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PITTSBURGH • KANSAS CITY • LOS ANGELES • MINNEAPOLIS • GOSHEN, IND. • PHILADELPHIA • NEW ORLEANS • ORLANDO, FLA. • SALT LAKE CITY  
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# 21 Smart ideas

## ONLY FORD GIVES YOU A CHOICE OF V-8 OR SIX

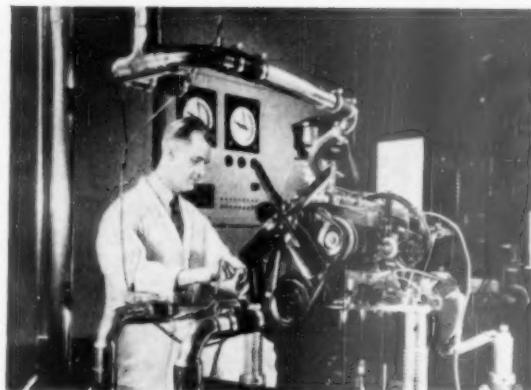
The Ford Truck line for 1950 gives you new models, new ratings, new power, new features—21 smart ideas in all, to help cut trucking costs.

**NEW MODELS** like the F-3 Parcel Delivery, which expand the 1950 Ford Truck line to over 175 models. This wide selection means that you should see your Ford dealer for the right truck for you, no matter what you haul. New G.V.W. rating increase on Series F-6 and F-8.

**NEW POWER** like the brand-new 6-cylinder Rouge 254 truck engine. Thus, for 1950 you have a choice of four great engines, two Sixes, and the only two V-8's in trucking. Only Ford gives you a choice of V-8 or Six.

**NEW FEATURES** like the full air brakes now available on the 1950 F-8 Big Jobs . . . single-speed axles for the F-6 and F-8 . . . new Synchro-Silent transmissions . . . new features that make driving safer and easier.

New models! New ratings! New power! New features! You'll find all these smart ideas in Ford Trucks for 1950. And you'll find the smartest idea of them all . . . Bonus Built construction which means big reserves of strength and power. That's why a 1950 Ford Truck is the smart buy for you. Your Ford Dealer can arrange quick delivery on most models. See him today!



★ **NEW 110-HORSEPOWER SIX!** The new Rouge 254 makes the 1950 Ford F-6 the most powerful 6-cylinder Ford Truck ever built. The thoroughly proved 254 has Free-Turn exhaust valves, Antifriction pistons, chrome-plated top piston ring, High-Lift camshaft, and many other power-producing, cost-saving, smart ideas. ★ A brand-new, 4-speed Synchro-Silent transmission engineered for quiet operation, easy shifting and long life is standard with the new 254 engine.



Model F-2, 5,700 lbs. G.V.W.  
Express or Stake



Model F-1, 4,700 lbs. G.V.W.  
Panel, Pickup or Stake



Model F-3, 6,800 lbs. G.V.W.  
Express or Stake



Model F-5, 14,000 lbs. G.V.W.  
Wheelbases, 134, 158 and 176 in.



Model F-4, 10,000 lbs. G.V.W.  
with Duals



Model F-3 Parcel Delivery  
Wheelbases, 104 and 132 in.

### America's No. 1 Truck Value!

**No. 1 in sales gains.** Registration figures show Ford Trucks are scoring bigger sales gains than all other makes combined, based on the latest three months, compared to the first three months of 1949!

**No. 1 in choice of engine types.** Only Ford gives you a choice of V-8 or six-cylinder engine design.

**No. 1 in experience.** Latest registrations prove that 2,003,155 Ford Trucks on the road have marked up 18,567,865 truck years of experience . . . a record equalled by no other truck.

**No. 1 in long life.** Using latest registration data on 6,106,000 trucks, life insurance experts prove Ford Trucks last longer.

**No. 1 in value.** Over 175 models! The only V-8's in trucking! Two 145-h.p. Big Jobs rated up to 39,000 lbs. They're Bonus Built which means big reserves of strength and power.

## Ford Trucks Cost Less Because—

# for 1950! \*

-IN A FULL LINE OF OVER 175 TRUCK MODELS!



★ NEW F-7 REAR BRAKES! Big 15" x 5" hydraulic, dual cylinder. High torque self-centering action both forward and reverse.



★ NEW WHEELBASES! Three of them for 1950 Ford Trucks. Series F-5 and F-6 now have a 176-in. wheelbase for bodies in the 15-ft. range. The 145-horsepower Ford Big Jobs have added two new wheelbases to get a total of five. First, a 147-in. wheelbase for tractors and dump trucks. Second, a 178-in. wheelbase for 15-ft. bodies.



★ NEW AIR BRAKES available on the Ford Series F-8 Big Job combine smooth flexibility with immediate, positive action.



★ NEW PARCEL DELIVERY! Forward control chassis with grille, windshield and quarter-windows. You add your choice of bodies. Available in Series F-3 and F-5 (Special order).

- ★ New single-speed rear axle for F-8
- ★ New extra-heavy duty clutch with 254 engine
- ★ Million Dollar Cab
- ★ Air Wing door glass ventilators
- ★ Level Action cab mounting
- ★ New Double Channel frame for Big Jobs
- ★ Gyro-Grip Clutches
- ★ New single-speed axle for F-6
- ★ Roll Action Steering
- ★ New extra H. D. drive line with 254 engine
- ★ Quadraflex rear axles
- ★ 4 engines—choice of V-8 or Six
- ★ New heavy duty, 3-speed Synchro-Silent transmission available for F-1 thru F-3
- ★ Choice of over 175 models
- ★ Bonus Built construction.



Model F-5 Cab-Over-Engine  
14,000 lbs. G.V.W.



Model F-5 School Bus Chassis  
Wheelbases: 158 and 194 in.



Model F-6 Cab-Over-Engine  
16,000 lbs. G.V.W.



Model F-6; 16,000 lbs. G.V.W.  
Wheelbases: 134, 158 and 176 in.



Model F-7; 19,000 lbs. G.V.W.  
35,000 lbs. G.T.W.



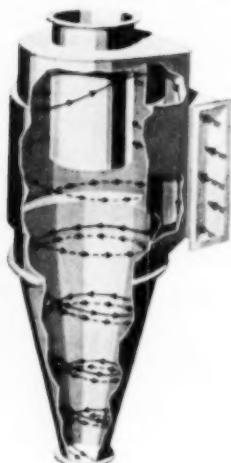
Model F-8; 22,000 lbs. G.V.W.  
39,000 lbs. G.T.W.

## FORD TRUCKS LAST LONGER

Using latest registration data on 6,106,000 trucks, life insurance experts prove Ford trucks last longer!

There's expert advice  
to be sought before  
tackling

# Dust RECOVERY



## Nobody knows

a foolproof formula that can be applied to all conditions. Each job requires individual engineering analysis...by specialists. Buell renders such a service, with no obligation to you. If a Buell Cyclone System can logically be recommended, it will be a tailored-to-the-job installation, of pre-measured and stated % efficiency. A Buell System naturally excels any ordinary cyclone, since it has the exclusive van Tongeren patented 'Shave-Off'. We invite your general or specific inquiry, and an opportunity to put service ahead of salesmanship. As a starter, let us send you the 32-page book, 'Engineered Efficiency'. Write: Buell Engineering Company, 70 Pine Street, Suite 5085, New York 5, N. Y.

**bue**  
Engineered Efficiency in  
**DUST RECOVERY**



## Super-7 TEXROPE V-BELTS

# These 7 Great Features Add Up To LONG V-BELT LIFE

**1** *Powerful Cord Structure* built up of hard-twisted, high tensile strength cords, impregnated with live rubber compound to prevent chafing and heating.

**2** *Thick, Resilient Cushion* of rubber supports cord structure at correct pitch line . . . absorbs shocks . . . helps dissipate heat.

**3** *Tough, double-wrapped cover* of long staple fibres, bias cut for elasticity and impregnated with rubber. Protects cords . . . seals out dust, grit, moisture.

**4** *Extra Stiffening Plies* of heavy fabric and rubber help keep the belt square in the groove.

**5** *Precision Molded And Cured* in accurate steel dies. Gives belt the straight sides necessary to provide the bulging gripping action that all V-belts need.

**6** *Every Belt Carefully Weighed* and inspected during construction. Assures perfect balance and uniformity.

**7** *Accurate Set Matching* . . . Every finished belt measured while running under load. Texrope multiple V-belts are matched in sets to assure uniform load on each belt.

### COMPLETE V-BELT SERVICE

Get everything you need for your V-belt drives . . . V-belts, standard and variable pitch sheaves and speed changers . . . from one reliable source. 144 page *Texrope Pre-engineered Drive* manual covers 90% of requirements. Get your copy today from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956. Also in Sweet's.

ALLIS-CHALMERS, 975A SO. 70 ST.  
MILWAUKEE, WIS.

*Texrope* and *Super-7* are Allis-Chalmers trademarks.

# ALLIS-CHALMERS



Super-7 *Texrope* V-Belts result from the cooperative research of Allis-Chalmers and B. F. Goodrich, and are sold only by A-C dealers and offices.

A-2836

**Sold . . .**

**Applied . . .**

**Serviced . . .**

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS —  $\frac{1}{2}$  to 25,000 hp and up. All types.

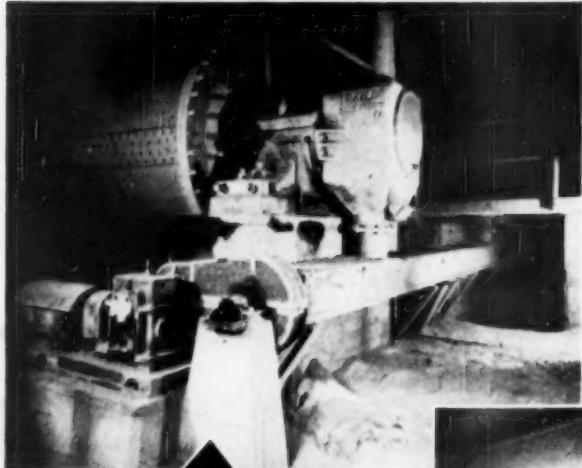


CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.



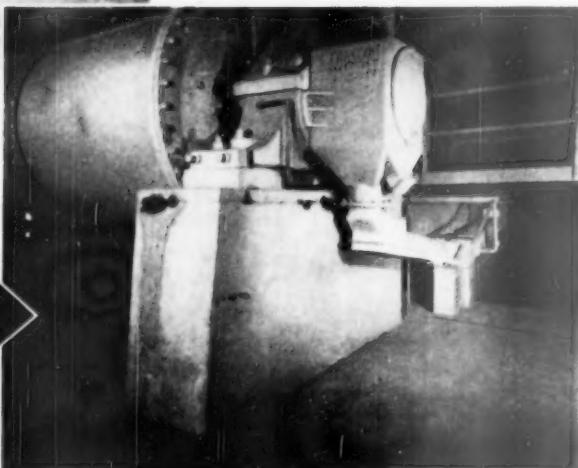
PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

# Two pictures that tell a story



BEFORE  
AND  
AFTER

ABOUT  
THE  
**F-H  
AIRSLIDE**



These two views, of the same installation, show the conveying of cement raw material from two tube mills . . . the old and new way.

**BEFORE:** Material was conveyed by a 12-inch screw conveyor, driven through a speed reducer, sprocket and chain, by a 5-hp. motor. Result—dusty and noisy; excessive power cost; lubrication; wear; hazardous moving parts. The ever present possibility of a breakdown of these many mechanical parts, with resultant shut-down for repairs or replacement, with consequent costly down-time and labor charges.

**AFTER:** Material is now conveyed by two 8-inch Airslides. Result—elimination of dust, noise, lubrication, wear, and hazardous moving parts. Power, (air for aeration of material being conveyed) approximately one-eighth horsepower for the two Airslides shown in the illustration.

**FULLER COMPANY**  
CATASAUQUA - PENNSYLVANIA

Chicago 3 - 190 So. LaSalle St.  
San Francisco 4 - 480 Chancery Bldg.



FULLER-KINYON	FULLER-FLUXO	AIRVEYOR	F-H AIRSLIDE	CONVEYING
SYSTEMS	ROTARY FEEDERS AND VALVES	ROTARY COMPRESSORS	SYSTEMS	
AND VACUUM PUMPS	INCLINED-GRADE COOLER	DRY PULVERIZED-		
MATERIAL COOLER	MATERIAL-LEVEL INDICATOR	AERATION		
UNITS	CONSTANT-HEAD FEEDER	SLURRY VALVES		
	MOTION SAFETY SWITCH	SAMPLERS		

F-H-9

# Announcing-ALL NEW-ALL PROVED INTERNATIONAL TRUCKS



## Every model *Heavy-Duty Engineered* to save you money!

Now International puts you squarely in the driver's seat—with a complete new line of completely new trucks!

Every single new International Truck from 4,200 to 90,000 pounds GVW is heavy-duty engineered to give you lower maintenance and operating costs.

Let the facts tell that story:

*Fact No. 1:* for 18 straight years Internationals have

led in sales of heavy-duty trucks (16,001 pounds and over GVW). The men who buy heavy-duty trucks buy on a basis of performance. They choose Internationals.

*Fact No. 2:* the same management men, the same engineers, the same test experts, the same production men who kept Internationals first in the heavy-duty field, have developed every new International Truck.

## Every model offers new high standards of comfort and easy handling



Here's relaxing roominess! Here's all 'round visibility! Here's a comfortable, adjustable seat! Yes—you get everything in the Comfo-Vision Cab!

You have full visibility in the one-piece Sweepsight



windshield. That convenient two-cluster instrument panel puts everything right in front of your eyes.

And when the truck starts to roll, you find that new Super-steering right for position, and positive control,

**AND TALK ABOUT FEATURES ...**

# Every new International Truck offers new improvements throughout!

**NEW Functional Styling**—Smart brawny appearance combines modern design with extreme practicability.

**NEW Outdoor Visibility**—Giant, one-piece scientifically curved Sweep-sight windshield, large side windows, two rear windows.

**NEW Comfo-Vision Cab**—Model for model "the roomiest cab on the road"—with comfort cushions, adjustable seats, controlled ventilation.

**NEW Super-Maneuverability**—More positive control from a more comfortable position; new wide-tread axles assure the shortest practical turning circle and greater stability.

Plus dozens of new features and refinements throughout every truck!

**NEW Engine Accessibility**—Special fender and hood design provides extra working space between engine and fenders—hoods easily removed.

**NEW Valve-in-head engines**—All test-proved for greater power, greater economy, greater stamina, greater efficiency.

**NEW Specialized Transmissions**—Types and gear ratios for any job... three-speed, four-speed and five-speed with direct drive or overdrive in 5th.

**NEW Rear Axles for any job**—Wider, sturdier rear axles—hydraulic single-speed, double-reduction and two-speed with electric shift.

**NEW Brake Systems**—hydraulic or air. Faster-acting, sure-stopping, longer-wearing—more efficient braking with less effort.

**NEW Steel-flex Frames**—Designed to provide an extra margin of strength combined with the right amount of flexibility.

**NEW Load-balanced Wheelbases**—Shorter wheelbases for standard body lengths provide better load distribution, better maneuverability.

**NEW Cradle-Action Springs**—Longer springs for greater riding ease... stronger springs, sturdier mounting and new spring suspension for longer life.



Proved in the mountains!



Proved on the Belgian Block!



Proved in heavy snowfall!



Proved on the twisty course!

## Every model proved under actual operating conditions!

There wasn't any price tag on the test program to prove the new International Trucks.

It was directed by men whose life work has been to develop better truck transportation. Test drivers were chosen as carefully as you do any key workers. All-outdoors was used for proving grounds. Laboratory analysis tests were backed up by track tests, then by actual road tests. Test convoys were run 'round the clock.

That's why every all-new, all-proved International Truck is right and ready for you now!

## Call or visit your International Truck Dealer or Branch

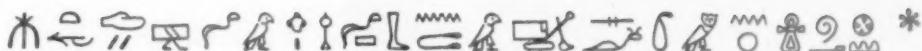
International Harvester Builds McCormick Farm Equipment and Farmall Tractors... Motor Trucks Industrial Power... Refrigerators and Freezers



Tune in James Melton and "Harvest of Stars"  
ABC, Sunday afternoons

# INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY  CHICAGO



In any language, the synonym for excellence in excavator service is "Bucyrus-Erie," as this 120-B shovel, working in a limestone quarry near Cairo, Egypt, can testify. That's because Bucyrus-Erie quarry and mine shovels, like the 5 cubic yard 120-B, combine strength and durability with responsive Ward-Leonard variable voltage control for fast, precise operation and sustained high production. The simplicity of the 120-B's "years ahead" design means easy maintenance, minimum time out for repairs and elimination of useless deadweight that slows cycle speed. The result is maximum

digging efficiency and outstanding performance through a long lifetime of profitable service. Other Bucyrus-Erie quarry and mine shovels from  $2\frac{1}{2}$  to  $6\frac{1}{2}$  cubic yard capacities.

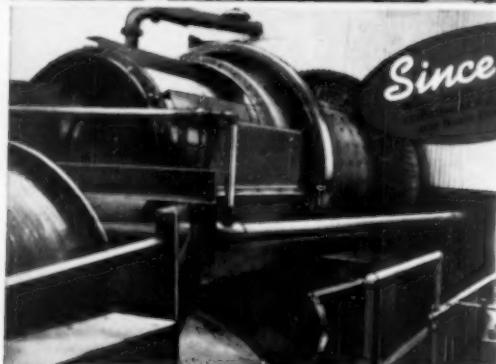
\*Translation:

*The Best Buy Bucyrus...  
The Best Buy in Excavators*

**BUCYRUS  
ERIE**

SOUTH MILWAUKEE, WISCONSIN

70149



# SERVICE RECORDS

for

# McLanahan

# Equipment

are counted  
in DECades  
instead of years

Plus hundreds of other  
service records . . .  
just as interesting

Long service records and amazingly low maintenance costs go hand-in-hand with McLanahan equipment. With the experience of more than a hundred years and an engineering organization which has pioneered many of the modern innovations of the industry—McLANAHAN is your logical headquarters for equipment. Write for specific information on any above or below surface modernization equipment.

Headquarters for Pit, Mine and Quarry Modernization

**McLANAHAN and STONE**  
*Corporation* *Since 1835*  
HOLLIDAYSBURG, PA.

# America's Most Outstanding Truck Values —with more power than ever!

Here are the models to make motor-truck history. These new Chevrolet P-L trucks are advance-designed for the heaviest loads, the roughest roads, the lowest cost per trip.

They are far ahead in popularity, performance, payload, price—and they are the *most powerful trucks Chevrolet has ever built*. There is a P-L truck for every trucking job and every one is a real leader on the job.

Chevrolet Motor Division, General Motors Corporation  
Detroit 2, Michigan

## Leading with all these Plus Features:

- TWO GREAT VALVE-IN-HEAD ENGINES: the New 105-h.p. Lead-Master and the Improved 92-h.p. Thrift-Master—to give you greater power per gallon, lower cost per load
- THE NEW POWER-JET CARBURETOR: smoother, quicker acceleration response
- DIAPHRAGM SPRING CLUTCH for easy action engagement
- SYNCHRO-MESH TRANSMISSIONS for fast, smooth shifting
- HYPOID REAR AXLES—5 times more durable than spiral bevel type
- DOUBLE-ARTICULATED BRAKES—for complete driver control
- WIDE-BASE WHEELS for increased tire mileage
- ADVANCE-DESIGN STYLING with the "Cab that Breathes"
- BALL-TYPE STEERING for easier handling
- UNIT-DESIGN BODIES—precision built.

## CHEVROLET

# P\*L\*

### ADVANCE-DESIGN TRUCKS

#### P\* Popularity Leaders

Official truck registration figures for 1949 show Chevrolet trucks preferred over the next two makes combined—proof of the owner satisfaction they earn through the years.

#### P\* Performance Leaders

The new Chevrolet P-L trucks give you high pulling power over a wide range of usable road speeds—and on the straightaway, high acceleration to cut down total trip time.

#### P\* Payload Leaders

The rugged construction and all-around economy of Chevrolet P-L trucks cut operating and repair costs—let you deliver the goods with real reductions in cost per ton per mile.

#### P\* Price Leaders

The Chevrolet truck line is the very lowest priced line in the field—saves on initial cost. What's more P-L trucks give owners dollar and cents savings in maintenance and operation.



# Symons Cone Crushers

**S**YMONS Cone Crushers and Symons Vibrating Screens, proven throughout the world in the most efficient stationary rock, ore and mineral processing plants, are being used in increasing numbers by successful operators of Portable and Semi-Portable Plants. Here are a few of the ever growing number of installations of Symons units in Portable and Semi-Portable materials producing plants.

The wide range of sizes and types of Symons equipment makes possible their use singly or assembled in combinations to fit your most exacting needs for producing greater tonnage of quality aggregate at lowest cost.

Whether you are a contractor, operator, high-

way construction engineer (municipal, county, state or Federal government), designer or manufacturer of Portable and Semi-Portable Plants, it will pay you to specify and use Symons machinery.

A series of suggested plant arrangements has been assembled into a new engineering brochure offering a wealth of information about the use of Symons Cone Crushers and Symons Vibrating Screens in Portable and Semi-Portable Plants. This brochure is especially valuable to *aggregate producers who are considering building their own plants, and to portable plant manufacturers*. It contains numerous drawings of single and multiple-stage plants, specifications, capacity charts, unit sizes, power requirements, conveyor sizes and other profitable information. Available free — no obligation. Send for your copy today!

## **NORDBERG MFG. CO.** **MILWAUKEE 7, WISCONSIN**

New York • San Francisco • Washington • Spokane  
Mexico, D.F. • London • Toronto • Johannesburg



30-ton Symons Standard Cone Crusher with power unit and conveyor mounted on a truck—locally built—Umatilla County, Oregon.

Symons 25-ton Vibrating Screen-Cone Crusher in a complete crushing and screening plant built by a prominent manufacturer of portable plants.



# **NORDBERG**

*Machinery for processing  
ores and  
industrial minerals*



Gyrocrusher and  
Jaw Crushers



Jaw  
Crusher



Vibrating  
Bar Grizzly

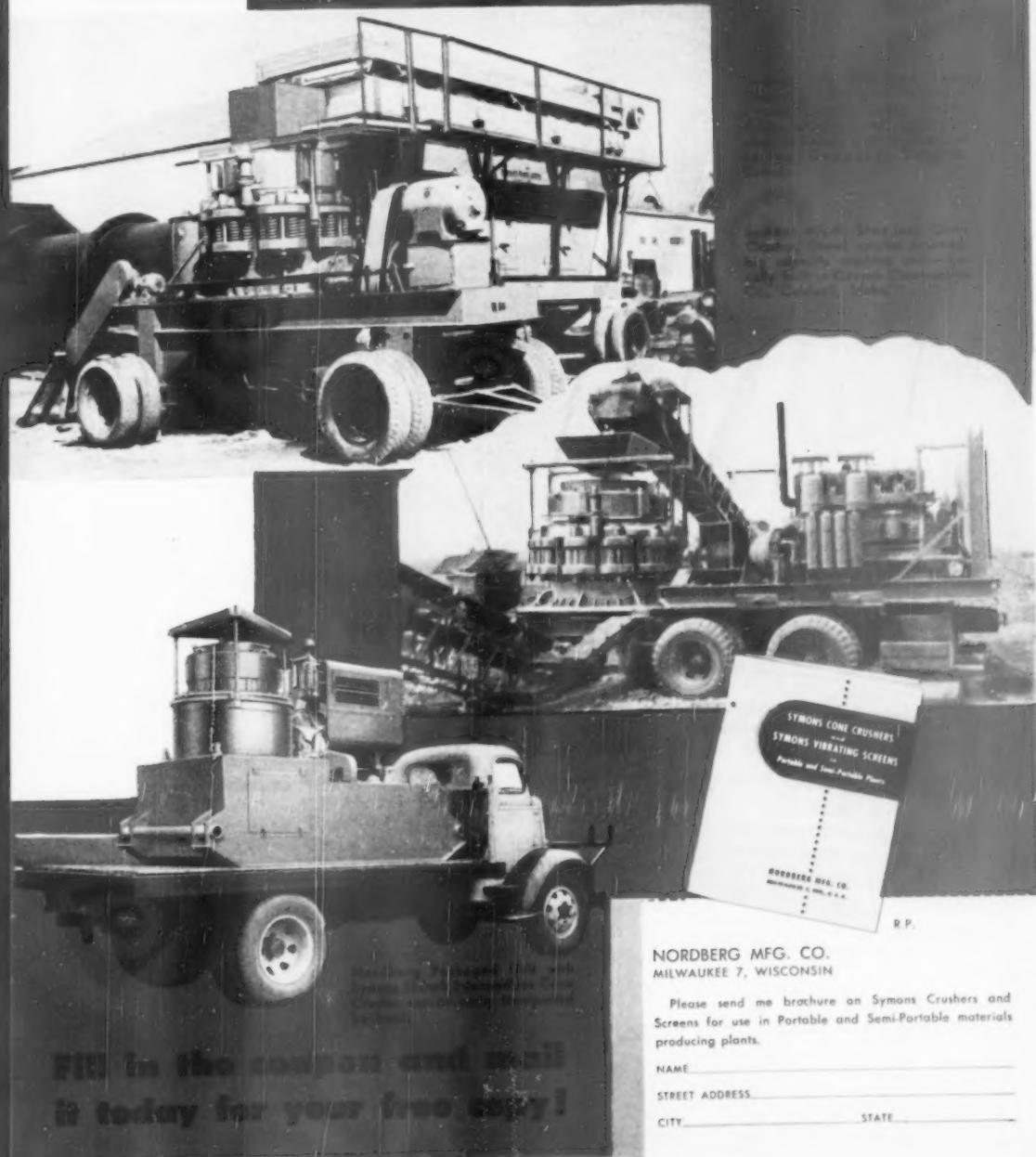


Symons Screen  
for Hot Plants



Diesel  
Engines

# IN PORTABLE



R.P.

NORDBERG MFG. CO.  
MILWAUKEE 7, WISCONSIN

Please send me brochure on Symons Crushers and  
Screens for use in Portable and Semi-Portable materials  
producing plants.

NAME \_\_\_\_\_

STREET ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

# New "HEAVY-DUTY" 2½-TON GMC TRUCKS



## Designed to Allow Operators in the 2½-Ton Range to Haul Bigger Loads at Less Cost

- More Powerful 270-cu.-in. "Army Workhorse" Engine
- Heavy Duty Rear Axle
- Five-Speed Direct and Optional Overdrive Transmissions
- New Heavy Duty Hydraulic and Optional Air Brakes
- Conventional and Cab-Over-Engine Models
- Six Wheelbases Providing Nine Cab-to-Axle Dimensions

Here's real "big" truck performance in the middle duty hauling range . . . here are GMC's new 470 models . . . trucks for over-the-road and off-the-highway operators that set new standards in 2 1/2-ton hauling ability.

These GMCs are all truck-built from exclusive bumper-bar grille to tough, rugged rear axle . . . offered in single, double reduction or 2-speed types. They have big GMC valve-in-head engines and are available with air brakes . . . features that make them highly desirable for both truck and tractor use.

GMC 470s, in ten models, are built to provide an extra margin of performance . . . to haul bigger loads at less cost in the aggregate transport field.

**GMC**  
GASOLINE • DIESEL  
**TRUCKS**

GMC TRUCK & COACH DIVISION • GENERAL MOTORS CORPORATION

# Another BWH First!



## NEW CONCORD #20 STEAM HOSE

(with Wire Braid Tube!)

## BREAKS ALL PERFORMANCE RECORDS!

1. During grueling test, Concord #20 Steam Hose "took it" for 1980 continuous hours of service at 200 lbs. steam pressure!
2. No interruption . . . full flow of steam was maintained during the entire test period. Pressure remained constant at all times!
3. Absolutely no evidence of hardening or swelling of the tube!
4. Amazing new construction locks tube between two braids of wire . . . makes recoupling quick and easy!
5. Cover is oil, grease, heat, sun and abrasion resistant!
6. Flexible and DURABLE . . . Your nearest BWH distributor will be glad to demonstrate the whip-like flexibility of Concord #20.

**HAVE YOU A JOB WHERE STAMINA COUNTS?**  
Bring us your toughest problems. We're specialists in solving them. Consult your BWH distributor or write us direct.

Another Quality Product of  
**BOSTON WOVEN HOSE & RUBBER COMPANY**

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS., U.S.A. • P.O. BOX 1071, BOSTON 3, MASS.

# Classifying ABRASIVE MATERIALS with

Special Raymond Separators are providing new concepts of operating and maintenance economy when handling highly abrasive materials.

With parts most subject to wear constructed of special abrasion resistant alloy castings, these separators are completely lined internally with replaceable liners for a maximum of trouble-free, long life.

Present users of these separators tell us that their maintenance and repair expenses when classifying abrasive materials have hit a new low.

If your operations include classifying silica sand, flint, feldspar, or similar materials it will pay you, too, to investigate these special Raymond Separators.



RAYMOND DOUBLE WHIZZER  
SEPARATOR  
CUTAWAY VIEW  
Showing standard construction for long and satisfactory service handling normally abrasive materials.

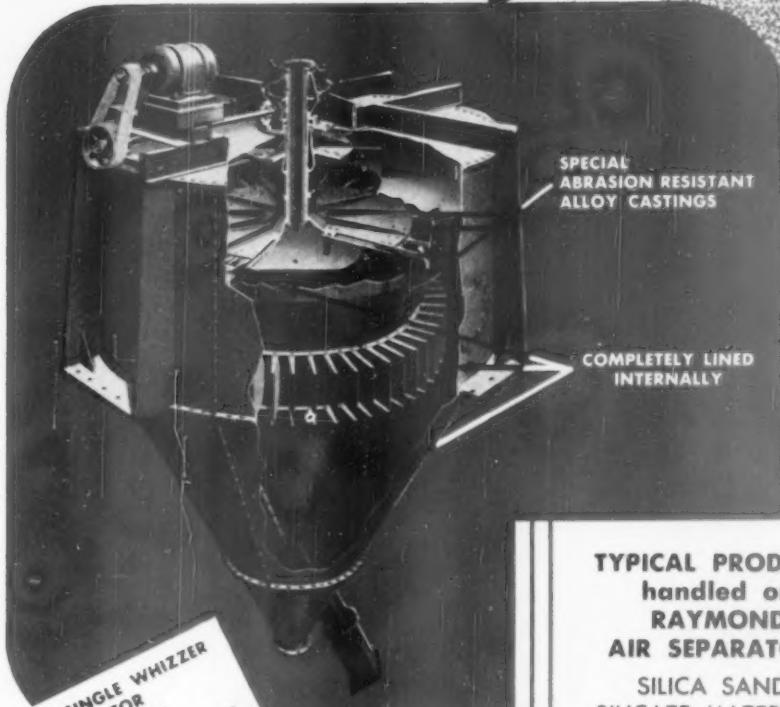
## TYPES AND SIZES

Raymond Mechanical Air Separators are made with either a Single or Double Whizzer, and in a commercial range of sizes from 4'0" to 18'0" diameter; also a 30-inch Separator and a 10-inch Laboratory Separator.

# COMBUSTION ENGINEERING

**RAYMOND PULVERIZER DIVISION**  
1307 North Branch Street      Chicago 22, Illinois

# RAYMOND WHIZZER SEPARATORS



RAYMOND SINGLE WHIZZER  
SEPARATOR  
CUTAWAY VIEW

Showing special construction  
for classifying abrasive  
materials. Used for medium  
fineness separation and for  
dedusting operations.

## IF YOU HAVE A PROBLEM

involving the classification of dry materials either with or without grinding, write us about it in detail. Our engineers will be glad to recommend the proper equipment for your job.

## TYPICAL PRODUCTS handled on RAYMOND AIR SEPARATORS

SILICA SAND\*  
SILICATE MATERIALS\*  
CEMENT CLINKER  
CEMENT RAW MIX  
HYDRATED LIME  
BURNT LIME  
GYPSUM  
FLINT\*  
FELDSPAR\*  
QUARTZ\*

\* Indicates materials for which special construction is recommended.

## -SUPERHEATER, INC.

Western Office: 510 West Sixth Street, Los Angeles 14  
Eastern Office: 200 Madison Avenue, New York 16



# HEAVY-DUTY



## KOEHRING HEAVY-DUTY SHOVELS CAN CUT YOUR EXCAVATING COSTS

Here is a profitable way to cut your stripping and materials handling costs all around. Match high-speed Dumper-hauling with dependable, heavy-duty Koehring excavators. It's a big production team, built to work together. Dumper's heavy-duty construction, easy-loading design, fast hauling and dumping, match Koehring excavator's rugged digging ability and fast-operating speeds . . . give you matched speed and strength to keep output high, costs low. For complete facts on the big  $1\frac{1}{2}$ -yard 605 (illustrated) . . .  $\frac{3}{4}$ -yard 304, or  $\frac{1}{2}$ -yard 205 excavators, see your Koehring distributor . . . or write for bulletin. **ASK, TOO, ABOUT BIG,  $2\frac{1}{2}$ -YARD 1005**



# for heavy hauling...

## DUMPTOR BODIES BUILT FOR HEAVY ROCK SERVICE

To meet the toughest hauling conditions of mine, quarry and construction service, Koehring Dumptors have a ton of strength for every ton of payload. Heavy-duty bodies stand up under the severest shocks of loading rock from big mine and quarry shovels. All-welded sides, ends and bottom are heavily ribbed with 4" channels. High-carbon steel gives extra strength at stress points where abrasive rock action is most severe. Three-layer bottom of seasoned 1-5/8" oak between two 5/16" steel plates cushions shocks.



## HEAVY-DUTY CHASSIS TAKES ROUGH HAUL ROAD SHOCKS

Rugged, 8" ship-channel main frame . . . 4" chrome steel drive axles . . . and cast alloy-steel "I" beam steering axle, add extra strength to Dumptor chassis. Big tires absorb road shocks. There are no leaf springs . . . only one big-double-coil spring on oscillating steering axle. That means no spring shackles to lubricate . . . no spring maintenance. And . . . you have 6 HP for every ton of gross vehicle weight for faster acceleration, less shifting, more grade-ability. Dumptors climb grades up to 24% with full load.



## NO BODY HOIST MAINTENANCE WITH GRAVITY DUMP

You don't lose time or spend money on body-hoist maintenance because Dumptors have no troublesome body hoists. Gravity dumps the full 6-yard load in one second. Free swinging, kick-out pan breaks suction, keeps dumping fast even in stickiest materials . . . adds an extra 3 1/8" steel to Dumptor bottom. Heavy-duty construction like this is your assurance that Koehring Dumptors will profitably stand up to your heaviest off-the-highway hauling assignments. Let your nearest Koehring distributor show you how.

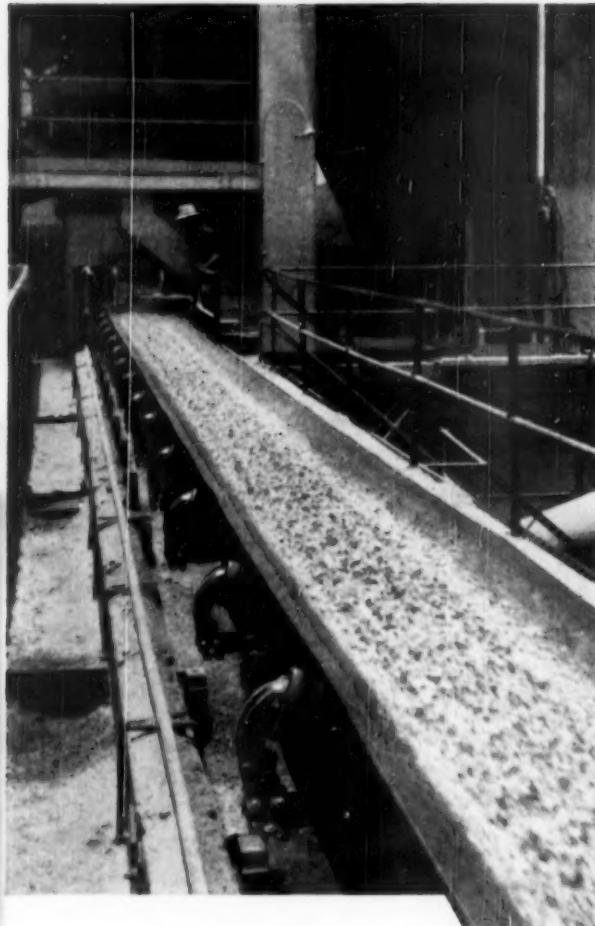


# KOEHRING

COMPANY, Milwaukee 10, Wisconsin

Subsidiaries: PARSONS • JOHNSON • KWIK-MIX

Dumptor® Trademark Reg. U. S. Pat. Off. K809



**25 YEARS AT  
HARD LABOR  
But  
Going Strong**

As strong and efficient as it was 25 years ago when it was installed, this rock conveying system proves the soundness of S-A design, engineering and equipment. It moves big tonnage of rock as quickly and at lowest cost per ton as if it had been installed only yesterday.

This rock handling system, operated continuously for a quarter of a century, simply proves how right S-A engineering principles have been. On every S-A designed and installed bulk materials handling system . . . the most materials move at lowest cost per ton. Even time has failed to make many such installations obsolete.

So when you consider an improvement or an entirely new system for your bulk materials put the question of what's best up to S-A engineers. There's no obligation so write today.

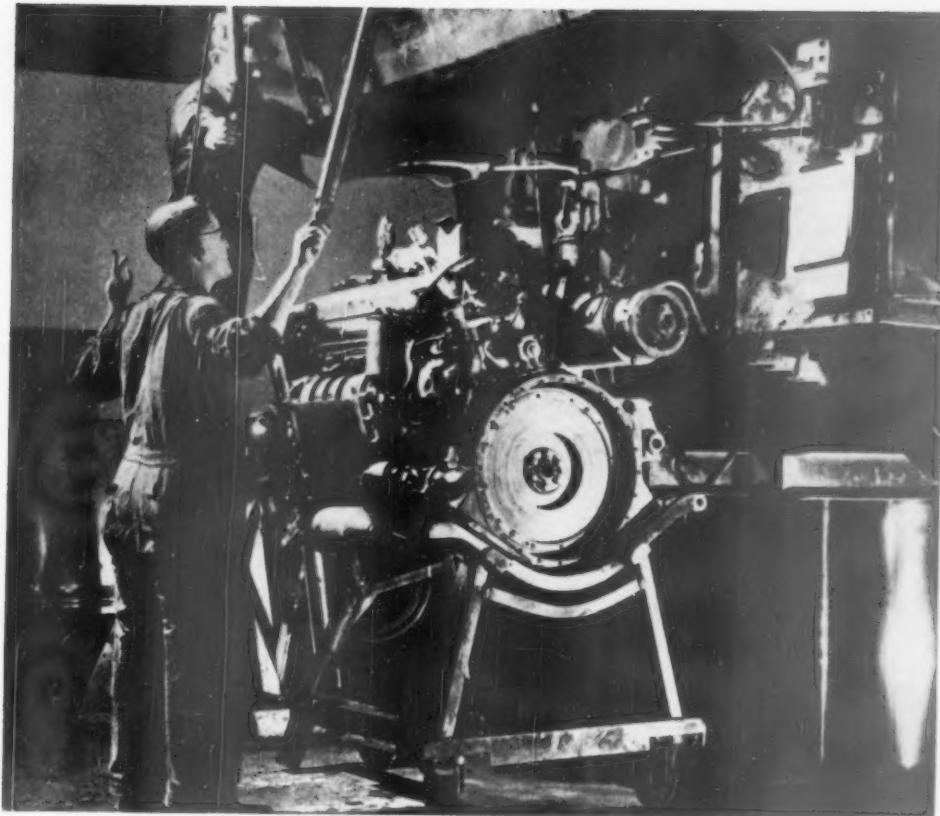
**SOUTHWESTERN PORTLAND  
CEMENT CO.  
VICTORVILLE, CALIFORNIA**

*Incoming lime rock is lifted to crusher from track hoppers under car unloading trestle by means of a huge 34" wide type "R" bucket elevator. It has 30" pitch chain and 100 ft. centers. Crushed lime is transferred to a 30" wide S-A belt conveyor which carries material out over storage area. Traveling tripper operates on rails alongside conveyor to discharge at any point along length of conveyor to storage pile below.*

**STEPHEN S-A DAMSON**

7 Ridgeway Avenue, Aurora, Illinois MFG. CO. Los Angeles, Calif. • Belleville, Ontario

**DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT**



## Extends the time between overhauls

**We don't have to tell** you that it costs real money these days to overhaul an engine . . .

. . . that more than ever it is good business to take every opportunity to extend the time between your overhauls.

With this in mind, we urge you to turn to Gulflube Motor Oil H.D. This heavy-duty oil helps increase availability, reduce maintenance costs. That's because Gulflube Motor Oil H.D. does two mighty important jobs extremely well:

### **1. It provides proper lubrication.**

Gulflube Motor Oil H.D. has a rich, full paraffin base that provides a particularly strong oil film and superior lubrication under the toughest operating conditions.

### **2. It helps keep engines clean because it is a fully detergent motor oil.**

Rings stay clean and free with Gulflube Motor Oil H.D., insuring better compression and proper oil control—and you'll get minimum oil consumption.

In addition, Gulflube Motor Oil H.D. contains a patented anti-foam agent which prevents crankcase foam under all conditions of speed and temperature. It is noncorrosive to copper-lead or other alloy bearings.

The Gulf Automotive Service Engineer will gladly assist you on problems relating to lubrication and maintenance.

Call him and ask him about Gulflube Motor Oil H.D. for *your* operation.



**GULF OIL CORPORATION - GULF REFINING COMPANY**

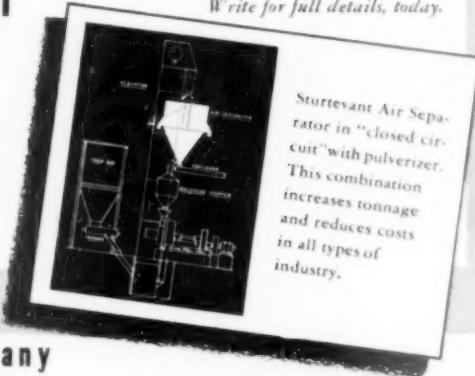
Offices in principal cities in 30 states.



# Here's How STURTEVANT Air Separators Increase Production of Fines... Lower Separation Costs

- Sturtevant Air Separators effect production savings by increasing output by 25 to 300%... reducing power consumption by as much as 50%.
- They efficiently carry off all classified materials in any desired fineness from 40 to 325 mesh and finer... eliminate the need of screening in certain applications.
- Capacities available from  $1\frac{1}{2}$  to 50 tons per hr.

*Write for full details, today.*



Sturtevant Air Separator in "closed circuit" with pulverizer. This combination increases tonnage and reduces costs in all types of industry.

**Sturtevant Mill Company**

102-A Clayton Street, Boston 22, Mass.

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

LOG IN  
TO

# UNIVERSAL FOR COST-CUTTING OUTPUT OF UNIFORM AGGREGATE

MORE TONS  
PER HOUR

## ROCK PLANTS



540-P primary jaw crusher with 800 Series secondary roll crushing, screening, and loading unit.

## LIME PLANTS



1800 Series secondary hammermill plant for producing aglime or road rock.

LESS COST  
PER TON

## WASHING PLANTS



Crushing, screening, and washing plant with primary jaw crusher, secondary rolls, scrubber, classifier, conveyors and bins.

## GRAVEL PLANTS



The TwinDual Master 24. Twice the capacity of conventional gravel plants of comparable weight. Three stages of reduction with primary jaw crusher and TwinDual rolls.

FOR PRODUCTION AT A COST  
THAT LEAVES MORE PROFIT  
BUY UNIVERSAL

Universal "Stream-Flo" Engineering provides the perfect balance of high capacity units to assure steady flow of properly graded material. No starving, no glutting . . . results in more tons per hour at less cost per ton. Meet today's demands for more production at bid-winning costs with Universal crushing, screening, washing and loading plants. Investigate. Compare. Write for literature today.

A Division of Pettibone-Mullican Corp. - Chicago

**UNIVERSAL ENGINEERING CORPORATION**

617 C AVENUE N.W.

CEDAR RAPIDS, IOWA

ENGINEERS AND BUILDERS OF "STREAM-FLO" ROCK, GRAVEL, AND LIME PLANTS, SCREENING AND WASHING PLANTS—CONVEYORS—APRON FEEDERS



This Belt Takes a  
Terrific Beating

## Manhattan Conveyor Belts are Built to Take It

This 30" Manhattan Conveyor Belt is handling hot filtered cement. Slurry conveyors such as this are notoriously tough on belts, but this Manhattan installation in an Oklahoma cement plant is paying for itself over and over.

Manhattan engineers are "Belting Pioneers" when it comes to designing conveyor belts for special duty.

### HOMOCORD — Special Cushioned Construction . . . Only for Conveyor Belt Use

In Homocord Conveyor Belt, Manhattan engineers devised a Strength Member that gives with the shocks of loading and dissipates hard blows. It has been called

a "Rippling Muscles Construction" because the Homocords have a flexible, resilient, rolling action with each other. Homocord Conveyor Belt is Cushioned, Tough, Flexible and Mildew-Proof, also holds metal fasteners.

### RAY-MAN — for Extra Long Lifts

Another Manhattan "First", built with Rayon Cord Strength Members. A "Tension Master" construction for longer lifts where you want to eliminate troublesome transfer points.

Whatever your conveyor belt needs, call a Manhattan Conveyor Belt Engineer to advise you on possible ways to lower your stone and aggregate handling costs.

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY



## RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive & Diamond Wheels • Bowling Balls

# Extra Pulling Power and Speed in Your Trucks with **EATON** *2 Speed Truck* **AXLES**

In the kind of service that requires extra pulling power and extra speed to make time on the open highway, Eaton 2-Speed Axles provide the perfect balance of power and speed. On trucks that must "take it," Eaton Axles reduce stress and wear—not only on the axles themselves, but on engines and all vital vehicle units. Longer axle life with minimum maintenance cost is assured because Eaton's exclusive forced-feed oiling system provides positive lubrication at all vehicle speeds. Eaton Axles are available for most trucks of 1½ tons and larger. Ask your truck dealer for a road demonstration.



*More Than a Million  
Eaton 2-Speed Axles  
in Trucks Today*

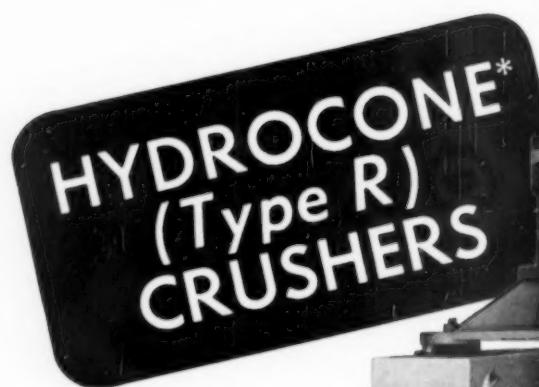


*Axle Division*  
**EATON MANUFACTURING COMPANY**  
CLEVELAND, OHIO



PRODUCTS: SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS • SPRINGTIES • SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS

# Now... Available in Larger Sizes!



\*The term "Type R" by which these Allis-Chalmers crushers have been known has been changed to "Hydrocone." "Hydro" denotes the use of a static liquid, such as oil, used in the Hydrocone crusher for supporting and adjusting the height of the crushing cone. The principle of operation has not been changed.

TO MEET new requirements for fine crushing in a larger range of capacities, Allis-Chalmers offers the expanded line of *Hydrocone* crushers, in sizes up to 1784 (17-in. receiving opening; 84-in. diameter cone) with coarse, intermediate or fine crushing chambers.

In the *Hydrocone* design the crusher's main shaft is raised or lowered hydraulically (push button operation on the larger sizes) permitting quick, accurate product size adjustment without stopping the crusher. An Automatic Reset device lowers the entire crushing head hydraulically to pass uncrushable materials.

ALLIS-CHALMERS, 975A SO. 70 ST.  
MILWAUKEE, WIS.

Hydro and Hydrocone are Allis-Chalmers trademarks.

## ALLIS-CHALMERS

Sales offices in principal cities in the U. S. A. — Distributors throughout the world.



### IT PAYS TO SPECIFY MOTORS... CONTROLS... V-BELT DRIVES — ALL FROM ALLIS-CHALMERS



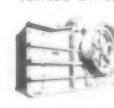
Motors — Controls



V-belt Drives



Vibrating Screens



Jaw Crushers

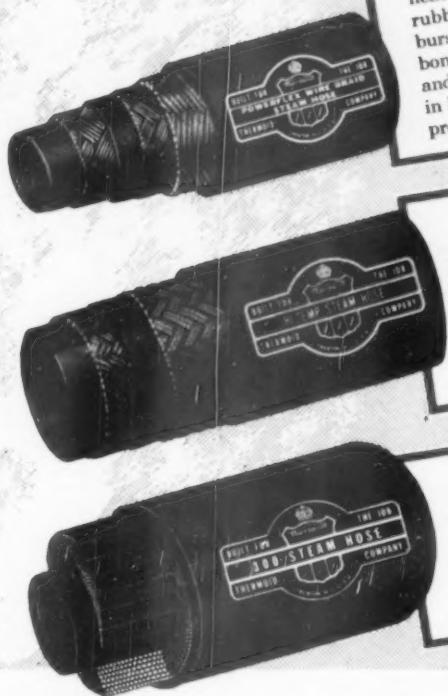


Kilns, Coolers, Dryers Gyratory Crushers

# Specify Thermoid Steam Hose

## Powerflex Wire Braid Steam Hose

Unequalled for strength and flexibility, it offers more capacity, greater safety, longer wear. The tough, thick, heat-resisting inner tube is of specially compounded black rubber . . . high-tensile steel wire braids safeguard against bursting . . . asbestos braid dissipates heat and firmly bonds the cover to the hose body. Special cover is heat and abrasion resistant. Furnished in sizes from  $1\frac{1}{2}$ " to  $2\frac{1}{2}$ ", in lengths up to 50 feet. An all-purpose steam hose for all pressures up to 200 psi.



## Hi-Temp Steam Hose

Mandrel-built—special heat-resisting rubber tube . . . braided asbestos-yarn reinforcement . . . heat and wear resistant cover. Furnished in sizes from  $1\frac{1}{2}$ " to 2" inside diameter in 25 or 50 foot lengths. A lighter weight all-purpose steam hose for superheated steam up to 200 psi.

## #300 Steam Hose

Heat-resisting rubber tube. Cotton fabric reinforcement. Heat and wear resistant cover. Furnished in sizes  $1\frac{1}{2}$ " to  $2\frac{1}{2}$ ", in 25 and 50 foot lengths. For general service where steam pressure does not exceed 150 psi.

**These latest developments** in steam hose are typical of the results obtained through Thermoid's continuing research and study of product applications. Thermoid's planned program of product research and development assures you of maximum service and lowest operating costs whenever you

specify Thermoid Industrial Rubber Products.

It will pay you to **Specify Thermoid!**

**Thermoid Quality Products:** Transmission Belting • F.H.P. and Multiple V-Belts • Conveyor Belting • Elevator Belting • Wrapped and Molded Hose • Molded Products • Industrial Brake Linings and Friction Materials.

**Thermoid  
Company**

Main Offices and Factory • Trenton, N. J., U. S. A.

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Industrial Rubber Products • Friction Materials • Oil Field Products

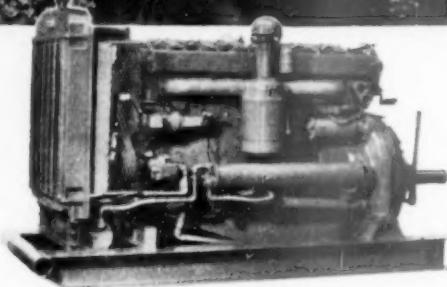


## means more output with MURPHY DIESELS

OWNERS everywhere find that the instantaneous response to load changes of Murphy Diesels means more output and more profit. Their easy starting, complete dependability and unequalled fuel economy, add to their popularity because of the boost they give to the profit side of the ledger. Here's what John S. Wenger of Wenger and Sensening, Paradise, Pa., has to say, "*The easy starting on cold mornings and the instant response of the governor to load changes are features we like particularly, while the dependability of the engines leaves nothing to be desired.*"

Plan now to improve your profit picture by getting full details on Murphy Diesel Power from your Murphy Diesel Dealer or write direct.

**MURPHY DIESEL COMPANY**  
5315 W. Burnham Street • Milwaukee 14, Wis.



**MURPHY  
DIESEL**

*Heavy duty  
power*

**for construction**

Murphy Diesel Engines and  
Power Units for construction,  
90 to 220 H.P. Generator Sets,  
60 to 133 K.W.

## MUD HOG CRUSHER

CRUSHES with  
GREATER EFFICIENCY

### WET -- STICKY MATERIAL

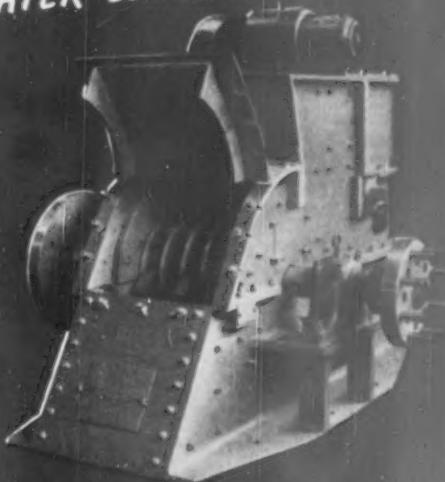
(LIKE CLAY, SHALE, ORES, CEMENT ROCK, ETC.)

that plugs or builds up in other types  
of crushers.

#### • CONVEYOR-TYPE BREAKER PLATE

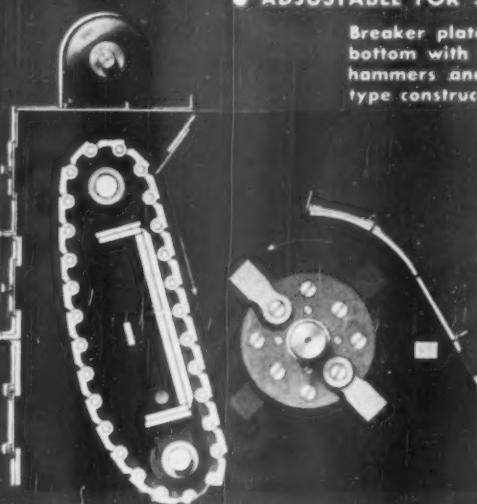
(see drawing)

Actually conveys stickiest material into  
path of heavy steel hammers, which  
crushes and sweeps breaker plate  
clean for next revolution . . . gear  
driven with separate motor . . . rugged  
construction.



#### • ADJUSTABLE FOR SIZE OF PRODUCT

Breaker plate supported at top by fixed drive shaft . . . at  
bottom with movable shaft for adjusting clearance between  
hammers and the crushing surface backed by heavy anvil  
type construction.



• CAPACITY — 40 to 350 tons per hour  
. . . depending upon product desired  
and crusher size.

• STREAMLINED — crusher frames of  
heavy plate steel . . . back frame flared  
for large discharge area . . . renewable  
liners throughout.

Larger sizes of the MUD HOG Crusher  
(reversible type) have two continuous-  
moving breaker plates . . . each adjust-  
able for a different size of product.

Bulletin No. 811

# JEFFREY

Complete Line of  
Material Handling,  
Processing and  
Mining Equipment

ESTABLISHED 1877



## Is your problem the handling of abrasive, lumpy or hot materials?

At right: Link-Belt 12" pitch steel apron conveyor, using  $\triangleright$  Flint-Rim  $\triangleleft$  enclosed-oiling rollers at chain joints.



Below: Link-Belt "No-Leak" apron conveyor, showing the close fitting, accurately formed pans with overlapping offset side plates welded to the ends.



Above: Link-Belt heavy-duty apron feeder with manganese steel pans, manganese chain, manganese sprockets and supporting rollers. It is particularly suitable for handling large heavy lumps.

**A Link-Belt apron conveyor may be the cost-cutting answer**

Link-Belt apron conveyors and feeders are not only suitable for the low-cost handling of abrasive, lumpy or hot materials but also for general use when handling materials of other characteristics either horizontally or on an incline.

They resist damage from sudden impact shock and from sharp edges of large lumps; withstand severe loading conditions; and deliver materials in a uniform flow. Installations beneath hoppers or crushers are typical applications when apron conveyors are used as feeders. They handle practically any loose, bulky materials such as ore, coal, steel scrap, castings, foundry refuse, sand, cullet, etc.

Link-Belt apron conveyors and feeders are available in several types and in a complete range of sizes and weights for every service requirement. Get in touch with the nearest Link-Belt office for complete information.

**LINK-BELT COMPANY** Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

11-708

**LINK-BELT**

**Power Transmission Machinery**  
**"THE COMPLETE LINE"**

## Here's the **MULTICLONE** Story in a Nutshell...

### **IT SAVES SPACE**

and we mean really important space savings. The chart here tells only part of the story because, in addition to being far more compact both in square and cubic footage, the *shape* of the MULTICLONE can be adjusted to fit various space requirements—long and narrow, short and wide, or square. You can often fit the MULTICLONE into tight spaces or waste areas too small for other equipment!

Model	Relative Space Requirements	
	In Sq. Ft.	In Cu. Ft.
Multicloner	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9



### **IT RECOVERS THE "FINES"**

as well as the coarser particles. Its patented *tube* design and small diameter tubes generate higher centrifugal forces, thus recovering a large percentage of the very fine particles 10 microns and less in addition to the heavier particles. MULTICLONE's high recovery of both small and large particles means high overall efficiency on any application!

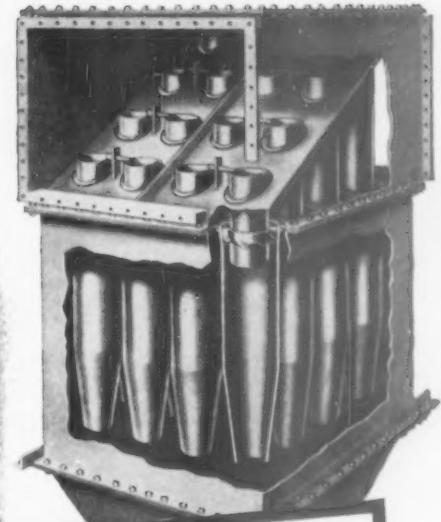
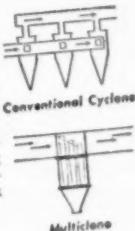
### **IT IS UNUSUALLY ADAPTABLE**

for, in addition to the *shape* adaptability outlined above, inlet-outlet connections are also easily adaptable. For low headroom, install the MULTICLONE with side-inlet, side-outlet. Or for tight side clearances, use side-inlet, top-outlet connections. Still other arrangements are possible for special conditions!



### **IT IS SIMPLE**

both to install and to maintain. For example, the MULTICLONE requires only single inlet and outlet ducts compared with the complicated multiple ducts of conventional cyclones. Not only saves space—but is simpler and cheaper to install and insulate. Moreover, the MULTICLONE has no filters to clog, no high-speed moving parts to maintain... and a single collecting hopper serves an entire bank of tubes!



On any dust recovery job  
—large or small—  
**the MULTICLONE**  
has many advantages!

WHY LIMIT your dust recovery job to one or two performance features when the Multicloner combines so many important advantages in the one unit? Check over some of the Multicloner's multiple savings outlined at the left. Note how—on every important feature—the Multicloner is the answer. These and other Multicloner advantages are the result of experience gained through more than 38 years of specialization in the science of dust recovery, beginning with the first commercial application of the well-known Cottrell Electrical Precipitator. Take advantage of these years of specialized study by installing Multicloner.



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PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

**GET ALL THE FACTS.** Send for this booklet that describes the many MULTICLONE advantages. Also let our trained engineering staff study your particular problem and show how MULTICLONE's multiple savings will benefit you. No obligation, of course.



COTTRELL  
PRECIPITATORS

MULTICLONE  
COLLECTORS

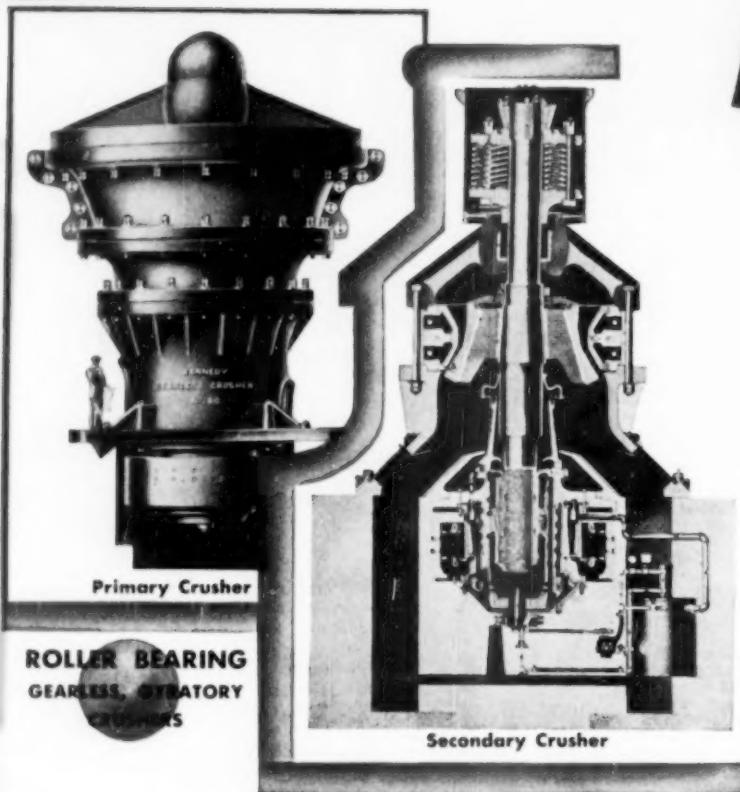
TURBULAIRES  
SILVER DUSTERS



LET'S

**TALK ABOUT A REAL CRUSHER**

**It's Rugged!**



- Synchronous motor built into pulley assembly
- Power applied ONLY for crushing
- Force-feed lubrication
- No gears to waste power
- Added power at no added cost
- Quiet — smooth Frictionless action
- Varying capacities to serve every purpose

Designed and built to produce, economically and consistently, maximum loads of uniform products. Assures efficient service with minimum "time off for repairs" under the most severe operating conditions.

Costs less in the long run because it has a larger capacity; uses less power; holds repair bills to a

minimum; produces more and better rock tonnage, faster and at lower cost.

Kennedy Crushers are made in various size units delivering from 12 to 3600 tons per hour. Engineered to serve your exact needs. Fifty years experience in the building of heavy duty crushers is your assurance that "It Costs Less To Own The Best" so use KVS equipment.

**Send for bulletins describing, fully, all types of KVS crushers**

**KENNEDY-VAN SAUN MFG. & ENG. CORPORATION**

*Look to P&H for Added Values*



## NOW, it costs LESS to do your jobs BETTER!

In every one of these operations, materials are being moved and handled for less—thanks to the continuous, cost-cutting performance of the P&H.

Of the many P&H Added Values, these alone will account for important savings for you. Add all the others and you know why so many operators, mindful of today's changing conditions, are putting P&H Excavators in their pits and yards.

**HYDRAULIC CONTROL**—years-ahead engineering makes P&H's faster and simpler to operate with a velvety action that's easier on man and machine.

**PLANETARY CHAIN CROWD**—P&H pioneered it; made it more accurate, more rapid reversing. Outlasts 25 to 30 crowd cables.

**TRUE TRACTOR TYPE CRAWLERS**—smoother, more maneuverable and dependable travel; easier steering; ends usual crawler troubles.

**WELDED CONSTRUCTION THROUGHOUT**—rolled alloy steels make them huskier, shockproof; no needless deadweight.

Get the full story on P&H Added Values. Mail coupon on your business letterhead now!



**P&H DUAL POWERED TRUCK CRANES**. One engine right for faster travel, another with power right for faster working. Converts for all classes of work. Available with P&H Remote Control.

**P&H CRAWLER EXCAVATORS**. Built in all sizes up to 6 cu. yds.; gasoline, Diesel or electric powered. Write for literature.

**P&H** EXCAVATORS  
4465 W. National Ave.  
Milwaukee 14, Wis.

**HARNISCHFEGER**  
CORPORATION

EXCAVATORS - ELECTRIC CHAMPS - ARC WELDERS - KNOTTS - WELDING ELECTRODES - MOTORS

**HARNISCHFEGER CORPORATION, Excavator Division**  
4465 W. National Ave., Milwaukee 14, Wisconsin

Gentlemen:

Send complete information covering P&H models from \_\_\_\_\_ to \_\_\_\_\_ cubic yards.

! ! Also P&H Truck Cranes. I am attaching coupon to my business letterhead.

Name \_\_\_\_\_

Company \_\_\_\_\_

Position \_\_\_\_\_

Address \_\_\_\_\_

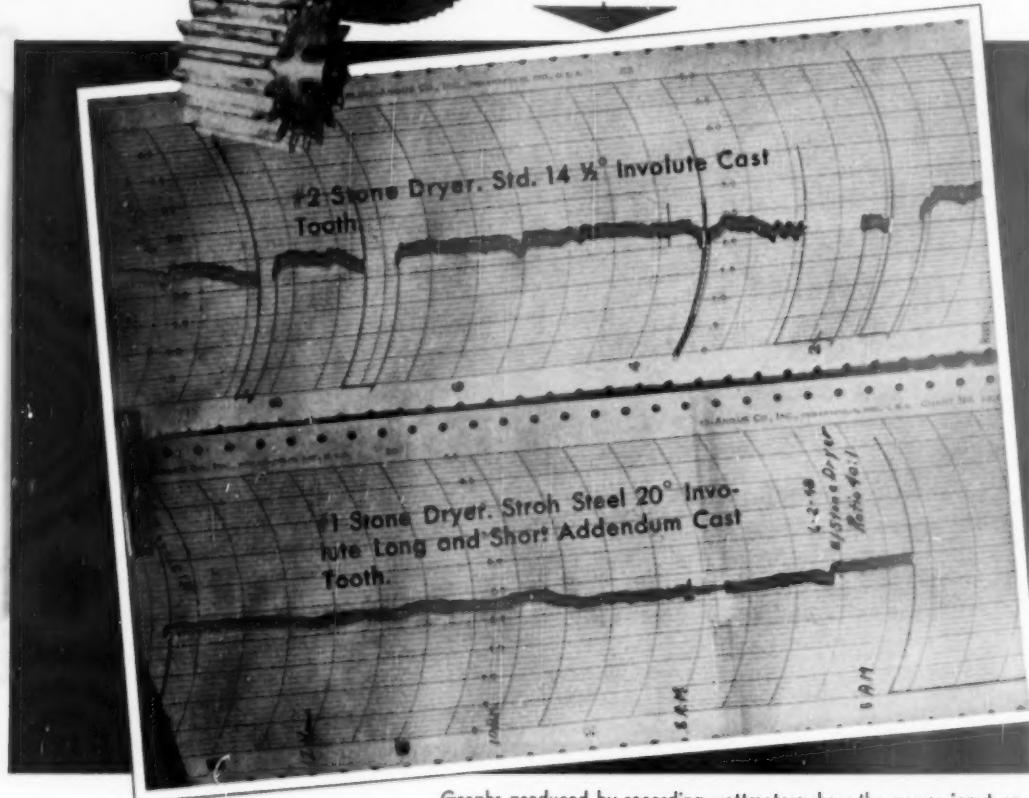
Zone \_\_\_\_\_ State \_\_\_\_\_

City \_\_\_\_\_

# STROH

These GRAPHS compare  
the actual performance  
under practically identical  
operating conditions of  
**HIGH REDUCTION  
CAST TOOTH GEAR DRIVES**  
on 8' x 100' A.C. Stone Dryers

Gear  
Pinion 104 Teeth, 4" C.P., 14" Face  
16 Teeth, 4" C.P., 14" Face



The smoother flow of power on the dryer operated by 20° Involute Long and Short Addendum Cast Tooth Gearing is apparent.

Wear-resistant Stroh Alloy on the active contour of the gear teeth maintains their original contour and insures continuity of a smooth flow of power.

**STROH  
PROCESS STEEL CO.**

Pittsburgh 12, Pa., U.S.A.  
Wallace Young, South American Representative

# Your Union Multiwall Specialist

Knows many ways to cut  
packaging costs

**H**OW LONG has it been since an *expert* analyzed your packaging methods?

Recent improvements in packaging methods and materials now make Union Multiwall Bags the preferred packaging for many different commodities . . . over 300 in all. They speed up packaging, cut labor and shipping costs, guard against contamination.

Even if you're now using multiwall bags, the Union Multiwall representative who calls on you can give you new ideas that may save you money. For he is backed by the specialized packaging knowledge of America's largest maker of paper bags—with its own forests, the largest completely integrated Kraft pulp-to-bag plant in the world, and skilled engineers and designers.

Let him show you how Union resources and packaging experience can help you!



## UNION Multiwall Bags

UNION BAG & PAPER CORPORATION

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# Which One is You?

**type one**



**type two**



**type three**



Do you drill holes all over the lot? A few in this cut—a few for that footing? Then you'll choose the lightweight LCM—the ideal wagon drill for use where moves are frequent.

Do your jobs call for fast drilling? Big footage on every shift? Then you'll want the universal URM—for the last word in wagon drill efficiency and performance.

Do you run into a lot of heavy rock excavation—with cuts up to 40 feet deep? Then the Gardner-Denver WD is the wagon drill for you. It's specially designed for deeper holes.



#### LCM FEATURES:

- Lightweight—easy to move
- Positive feeding pressure
- Convenient feed and drill controls
- Highly maneuverable
- Equipped for 6-foot steel changes

#### URM FEATURES:

- Simple, responsive controls
- Maintains correct bit pressure
- Positive, effortless blowing
- Adjustable wheels and mast
- Handles 6-foot steel changes

#### WD FEATURES:

- Extra powerful blowing
- Pneumatic feed
- Power operated mast
- Adjustable to any position
- For 10 or 15-foot steel changes

**Whether your drilling pattern fits Type 1, 2 or 3—choose a Gardner-Denver Wagon Drill for faster, easier drilling. Write for Bulletin WD-1.**



**GARDNER-DENVER** Since 1859

Gardner-Denver Company, Quincy, Illinois

In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

# DEMPSTER DIGGSTER

## Now Available With Two Types Of Traction

The revolutionary Dempster-Diggster, which is setting production records everywhere, is now available on crawler-type tractors as well as on the rubber-tired wheel type tractor. Both the rubber-tired and new crawler-type units feature the exclusive hydraulic crowd and hoist action that enables the Diggster to dig out the hardest chert bank . . . that permits digging 15 inches below and 15 feet above surface . . . that permits the bucket to follow the slope of the material in loading or stockpiling. Both units dig . . . load . . . bulldoze with equal efficiency.



If you're looking for a shovel that tackles big and small jobs alike with speed and economy of operation, your best bet is the Dempster-Diggster. It "spins on a dime" . . . loads and dumps faster . . . gets in those "hard-to-get-at" places . . . handles with a fingertip touch. For truck speeds on the road—to and from the job—it's the rubber-tired unit . . . for fast, efficient operation in difficult terrain, it's the new crawler-type unit. One of them is sure to fit your needs. Write today for complete information! A product of Dempster Brothers, Inc.

Photo above shows the new crawler-type Dempster-Diggster with 1 cu. yd. (hoisted) digging bucket at its maximum hoisted position. Top photo at left shows the Dempster-Diggster rubber-tired unit digging out a 15 ft. bank of hard chert. Bottom photo at left shows the crawler-type unit ready to dump load into truck.

**DEMPSTER  
DIGGSTER**  
ROCK PRODUCTS

**DEMPSTER BROTHERS**  
320 N. Knox • Knoxville 17, Tenn.

# It's got what it takes *for the jobs that you've got*

VERBURDEN or pay material—stone or gravel—long hauls or short . . . here's a hauling unit that's ready to take on the toughest jobs you can give it. All it wants is to keep busy. With *power, ruggedness, dependability, big capacity*—and a reasonable amount of maintenance—it will roll up for you multi-thousands of hours of low-cost hauling.

It's a "Cat" DW10 Tractor and matching Athey PD-10Q rock trailer, that can move 15-ton loads of rocky stuff at a 24.5-mpg. clip. On this Illinois limestone quarry operation, pictured below, an average of  $8\frac{1}{2}$  trips an hour are made on a 3000-foot one-way haul. Production averages 127 tons per hour—or about 1010

tons per 8-hour day. (Note that load can be dumped to either side. Hydraulic ram operation makes it easy.)

If you're interested in increased production, Diesel economy and outstanding day-after-day performance, you just can't beat an outfit like this. Behind it are a responsible manufacturer and a widespread, splendidly equipped dealer organization that can provide quick and efficient service at all times, at reasonable cost, no matter where you are located. For further information, see your "Caterpillar" dealer. Meantime, **USE THE COUPON—now.**

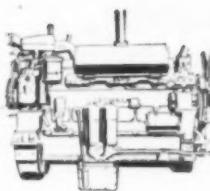
CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

NOTE. DW10s are also available with matching "Caterpillar" W10 Wagons and No. 10 Scrapers.

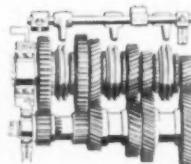


*Look under the side*

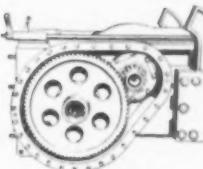
OF THE "CAT" DW10



**ALL "CATERPILLAR" BUILT.** Undivided manufacturer responsibility! Engine, transmission, clutch and final drive—all are 100% "Caterpillar" built and designed for each other. The engine, 115 honest horsepower, is known the world over for its dependable and economical performance. Its own independent gasoline starting engine is itself started electrically, or can be started by hand in case of battery failure. The engine is the heart of your operations . . . use the best.



**QUALITY BUILT** Typical of the quality designed into the DW10 is the constant-mesh, easy-to-shift transmission. A gear-type pump forces oil over the upper shaft to lubricate effectively the transmission on any grade. To insure long life, a large replaceable filter element guards against destructive abrasive materials. Just one of the many features that can boost production for you.



**SPEEDS UP TO 24.5 MPH.** Three complete ranges of speed are available with a choice of final drive gears. Many operators keep all three sets in stock to fit their DW10s to the job, ground conditions or haul distances. Differential-type rear end, combined with steering brakes, enables the DW10 to "walk" through soft spots on the hill. Full-floating drive axles are an assurance of dependable performance under the roughest of conditions.



**EASY SAFE OPERATION.** One way to get high earthmoving production is to design equipment for safety and ease of operation. Four-wheel stability; hydraulic booster steering; selective-acting air brakes on the DW10 and trailed unit; hydraulically controlled spring-mounted seat and unexcelled visibility—these add up to all important reasons why operators prefer DW10s.



**EASY TO MAINTAIN.** "Caterpillar" has always designed for ease of service. Fuel injection equipment that can be replaced like spark plugs, with no adjustments required; a metallic-lined double-disc flywheel clutch that can be removed without disturbing engine or transmission—these are just two of many reasons why owners report full satisfaction. Hundreds of well-equipped "Caterpillar" dealers, each within easy job distance, constitute another reason why DW10s boost hauling profits.

# CATERPILLAR

REG. U. S. PAT. OFF.

**DIESEL ENGINES**  
**TRACTORS**  
**MOTOR GRADERS**  
**EARTHMoving EQUIPMENT**

**CATERPILLAR TRACTOR CO.**

**Dept. RP-2, Peoria, Illinois**

Please send me your latest booklet, "The 'Caterpillar' Diesel DW10 in Action."

Name \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_





These big sand pumps handle thickened slimes at the outlet of Miami Copper's 8,000,000 gallon thickener. Operators like the Gates Vulco Rope Drives because if anything happens to a pump and the drives get wet these V-Belts, which run in grooved sheaves, do not slip off. Also, a simple change in sheave size easily provides a considerable change in pump speeds.



## Two Distinct Savings in V-Belt Costs Are Yours with Gates Vulco Ropes

A simple test that takes less than two minutes will save you many dollars in V-Belt costs. Here it is...

Have someone bend a V-Belt exactly as it bends 'n going around its pulley. As it bends, grip its sides with your fingers. You will feel those sides *change shape*. In a straight-sided V-Belt, the sides become *convex* as the belt bends. And note how the sides *bulge out*. (Figures 1 and 1A)

Now try the same test with a V-Belt that is built with the concave side. You will feel a change in shape—but a *different result*! The sides do not become *convex*. Instead, they become perfectly *straight*. The bent belt now has a shape that exactly fits its sheave groove—as shown in Figures 2 and 2A.

Two distinct savings result. First—There is no side-bulge to cause uneven wear. The sides press *evenly* against the V pulley and therefore wear *uniformly*—resulting in *longer life*! Second—The full width of the sidewall grips the pulley—thus carrying heavier loads without slippage—and this *saves belts* and also *saves power*!

When you buy V-Belts, be sure you get the V-Belt with the Concave Sides...the Gates Vulco Rope!

### What Happens When a V-Belt Bends

Straight-Sided V-Belt



How Straight-Sided V-Belt Bulges in Sheave-Groove.

Gates Vulco Rope with Concave Side.



No Side Bulge. Precise Fit in Sheave Groove.

THE GATES RUBBER COMPANY

DENVER, U.S.A.

The World's Largest Makers of V-Belts

**GATES VULCO ROPE DRIVES**  
IN ALL INDUSTRIAL CENTERS

Engineering Offices  
and Jobber Stocks

of the U. S. and  
71 Foreign Countries

You can "EUCLID" for  
depend on

**MORE PROFIT IN EVERY PAYLOAD!**



● Rear-Dump Euclids are designed and built to move rock, coal, ore and overburden and other heavy excavation at the lowest cost. Easy loading ... large capacity ... speed on the haul road and dump ... long life in heavy duty service ... these are some of the Euclid features that mean more pay in every payload.

There are models for every off-the-highway hauling requirement. Some of the variations in models that are available include five or ten speed transmissions ... semi-rigid or spring mounted drive axles ... manual or hydraulic booster steering ... standard or quarry type body.

Excellent parts and service facilities of a worldwide distributor organization are quickly available ... assure prompt, efficient service when needed. For full information on the Euclid line of earth moving equipment call or write today.

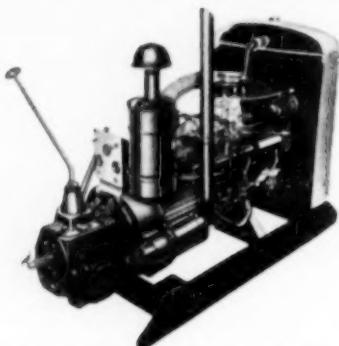
The EUCLID ROAD MACHINERY CO. Cleveland 17, Ohio

**EUCLID**



# IT'S HERE...

## NEW *Ford* "226" POWER UNIT



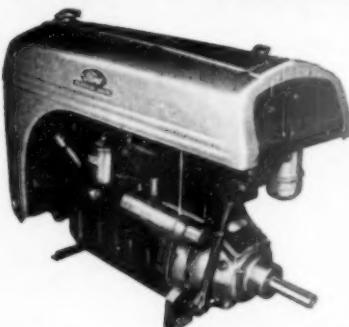
Pad mounted oil filter . . . Full length water jacketing . . . Recirculating pressure cooling system with thermostat . . . Counterbalanced crank-shaft . . . Heavy duty, replaceable thin shell copper lead bearings . . . High lift camshaft . . . Balanced carburetion (downdraft or updraft) . . . Heavy duty oil bath air cleaner.

## NEW *Ford* "239" POWER UNIT



Dual water pump . . . Full length water jacketing plus . . . Recirculating pressure cooling system with thermostat . . . Fully counterbalanced crankshaft . . . Replaceable thin shell bearings . . . Moly-chrome valve seat inserts . . . Dual downdraft carburetion . . . Oil filter and air cleaner.

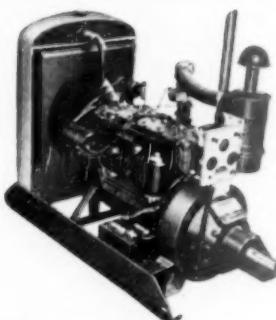
## NEW *Ford* "120" POWER UNIT



Removable dry cylinder liners . . . 3-ring pistons, chrome top ring . . . Moly chrome valve seat inserts . . . Circulating cooling system with thermostat . . . Replaceable thin shell main and connecting rod bearings . . . Counterbalanced crankshaft . . . Magneto or battery ignition . . . Oil filter . . . Heavy duty oil bath air cleaner.

# Complete

## NEW *Ford* "254" POWER UNIT



Pad mounted oil filter . . . Recirculating pressure cooling system with thermostat . . . Autothermic pistons with chrome top compression ring . . . High lift camshaft . . . Hard faced cobalt exhaust valve (free type valves) . . . Counterbalanced crankshaft . . . Heavy duty, replaceable thin shell copper lead bearings . . . Balanced carburetion (downdraft or updraft) . . . Air cleaner.

**RIGHT** for Centrifugal Pumps . . . Arc Welders . . . Air Compressors . . . Cranes and Hoists . . . Winches . . . Railway Cars . . . Generator Sets . . . Crane Loaders . . . Feed Grinders . . . Mechanical Shovels . . . Portable Sawmills . . . Portable Well Drills . . . Farm Combines . . . Street Flushers . . . Concrete Mixers . . . Portable Grain Mills . . . Irrigation Equipment . . . Log Yards and Loaders—and many other applications.

Specifications of Ford Industrial Engine Power Units

Model	Cylinders	Bore and Stroke	Displ. cu. in.	Dyn. B.H.P.	Max. Torque	Equipment Available
120	4	3 1/2 x 3 1/4	120	38 @ 2400	928' @ 1600	Clutch, SAE #5 housing, power take-off, Ford housing, 3-, 4- or 5-speed transmission, governor, (Available as closed or open type power unit, or engine assembly.)
226	6	3.3 x 4.4	226	80 @ 2400	1828' @ 1200	Clutch, SAE #3 or #4 housing, power take-off, Ford housing with 3-, 4- or 5-speed transmission, governor, (Available as closed or open type power unit, or engine assembly.)
239	V-8	3 1/2 x 3 1/4	239	85 @ 2400	1878' @ 1600	Clutch, SAE #3 or #4 housing, power take-off, Ford housing with 3-, 4- or 5-speed transmission, governor, (Available as closed or open type power unit, or engine assembly.)
254	6	3.5 x 4.4	254	95 @ 2400	2128' @ 1200	Clutch, SAE #3 or #4 housing, power take-off, Ford housing, 3-, 4- or 5-speed transmission, governor, (Available as closed or open type power unit, or engine assembly.)
337	V-8	3 1/2 x 4 1/2	337	117 @ 2400	2578' @ 1600	Clutch, 5-speed direct-in fifth transmission, power take-off, Ford housing, 3-, 4- or 5-speed transmission, governor, (Available as closed or open type power unit, or engine assembly.)

**FORD**

Industrial Engine Power Units  
ARE RIGHT 3 WAYS  
for your job!

**RIGHT POWER**—five great models in wide variety of units. Each one ready to run!

**RIGHT FEATURES**—all the latest advancements of Ford's famed progressive engineering.

**RIGHT SERVICE**—as near as your nearest Ford Dealer, clear around the world.

# Line of NEW



# POWER UNITS!

### NEW Ford "337" POWER UNIT



Drop forged fully counterbalanced crankshaft, hardened journals . . . Heavy duty, replaceable thin shell copper lead bearings . . . Hard faced cobalt exhaust valves (free type valves) . . . Autothermic pistons, chrome top ring . . . Dual centrifugal water pump . . . Full length water jackets . . . Recirculating pressure cooling system with thermostat . . . Dual downdraft carburetion . . . Oil filter and air cleaner.

YOUR JOB IS WELL-POWERED  
WHEN IT'S FORD-POWERED

For Special Literature on  
Ford Industrial Power Units, use this coupon . . .

Industrial Engine Department

**FORD MOTOR COMPANY**

DEARBORN, MICHIGAN

● Ford Industrial Power Units are now available in five great models . . . four, six and V-type eight cylinder . . . 120 to 337 cu. in. displacement. **COMPLETE** with radiator . . . instrument panel and S.A.E. or Ford type housings. Foot or skid mounted. Closed and open types. Made throughout to Ford's famed hi-precision manufacturing standards. Completely tested and **READY TO RUN!**

Ford Dealers, Ford District Sales Offices and the Ford Industrial Engine Department are at your service in developing engineering recommendations showing how Ford Industrial Power Units can be most effectively applied to your job. *Mail coupon below for Ford Industrial Power Unit Folder.*

Send me comprehensive literature about the new Ford Industrial Power Units. Address: Industrial Engine Dept., Ford Motor Co., Dearborn, Mich.

NAME \_\_\_\_\_ (Please print)

STREET \_\_\_\_\_

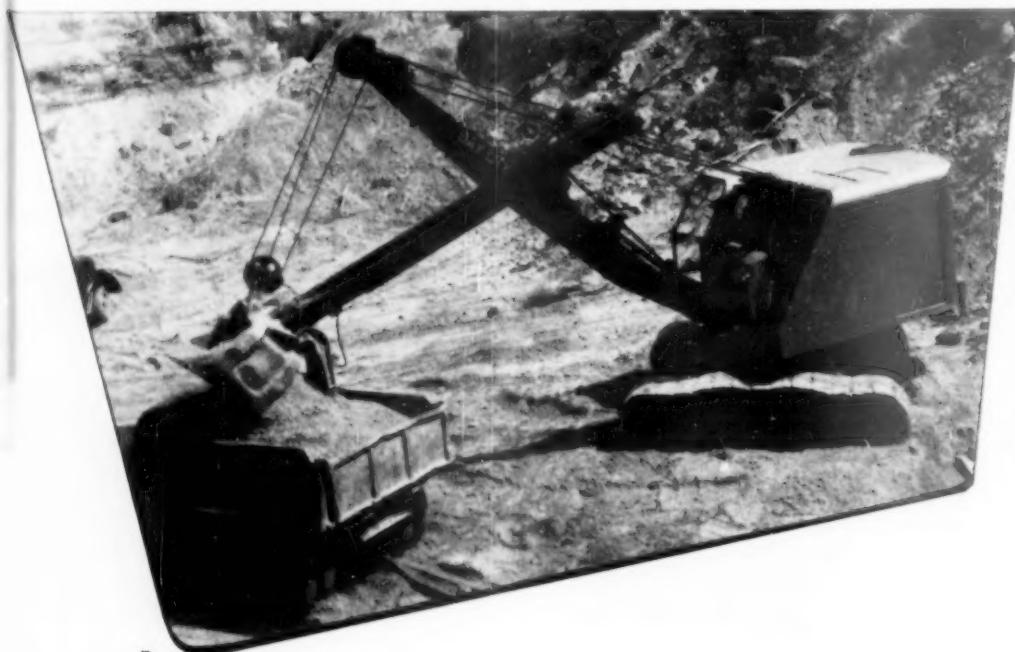
CITY \_\_\_\_\_ STATE \_\_\_\_\_

# What do you get when you buy a $\frac{3}{4}$ yard shovel?

to get the  
most for your money  
make your own  
comparison

A few essential specifications of the heavy-duty 45 are listed here so you can compare them with other  $\frac{3}{4}$  yard shovels. Make your own comparison and you will buy BAY CITY for the biggest value in excavating and material handling equipment. Let's get acquainted — Write for catalog today. BAY CITY SHOVELS INC., Bay City, Michigan

	BAY CITY MODEL 45	Other $\frac{3}{4}$ Yd. Shovels
WEIGHT	45,000 lbs.	
POWER	81 HP @ 1200	
ENGINE DISPLACEMENT	517 Cu. In.	
SHOVEL BOOM	19'-0"	
CROWD	One-piece Chain	
DIGGING RADIUS 45°	28'-1"	
CRANE BOOM (STD)	35' Pin-connected	
CRANE CAPACITY, 10' RAD.	27,300 lbs.	
BASES	Cast alloy steel	
GEARS	Helical Cut	
CLUTCHES	Mechanical power	
CRAWLER LENGTH	12' 6"	



## BAY CITY



SHOVELS • CRANES • HOES • DRAGLINES • CLAMSHIELDS

Another Example of  
Why Leading Contractors  
Prefer Lippmann Equipment

Crushes  
**A MILE-LONG  
TRAINLOAD  
OF HARD LAVA ROCK  
PER DAY!**

**Lippmann 36x48 GRIZZLY KING, World's Largest  
Overhead Eccentric Jaw Crusher, Hits Amazing Peak  
of 5700 Tons per Day for Big Colorado Quarry.**

36 x 48 GRIZZLY KING was fed by two 2-yard shovels, reduced hard lava rock to minus 6 in. at 360 tons per hour. Lippmann Jaw Crushers have extremely low power consumption, have never had a shaft or bearing failure with proper maintenance.

On large jobs or small, more and more experienced operators are using Lippmann equipment. Take the case of the big Colorado quarry that was awarded a huge contract to make aggregate from lava rock so hard that ordinary steel drill bits would not do the work and carbide tips had to be used.

This contractor, despite a slow start because of bad weather, wound up his first season comfortably ahead of schedule. To do this, he operated his 36 x 48 Lippmann GRIZZLY KING Jaw Crusher two eight-hour shifts . . . hit a peak of 360 tons per hour . . . 5700 tons per day!

Blast-run rock was fed on a Lippmann Super-Duty Feeder to the crusher. GRIZZLY KING'S extra-long jaws, engineered crushing action, complete oil lubrication and alloy steel construction provided the tremendous capacity required at extremely low maintenance costs. (Actually only a few bolts were replaced during the entire seven month

season; no die replacements, even with this highly abrasive rock.)

Other high-capacity, low-maintenance Lippmann-engineered equipment on this huge job includes five Screen-All Vibrating Screens with sharper sizing action . . . 12 Lippmann Belt Conveyors whose Life-Sealed Ball Bearing Idlers never require added lubrication . . . six sturdy Lippmann bins.

You, too, can profit by the experience of the country's leading contractors who choose Lippmann over all other makes. Lippmann engineering means higher capacity at lower cost . . . more efficient operation with less maintenance.

**OTHER 36x48s PROVE REAL MONEY MAKERS**

- Replacing a competitive unit, GRIZZLY KING balanced designed allowed an Indiana quarry to double its output with the rest of the equipment unchanged. Increased production will pay the entire crusher cost in two years.
- On a hard limestone job in Tennessee, balanced design of GRIZZLY KING has crushed 2,500,000 tons in two years without a single jaw die replacement.
- In a hard limestone quarry, GRIZZLY KING 36 x 48 produced half a million tons of minus 3½ in. stone in first six months' operation. Balanced design kept jaw dies "looking like new."

NOTE ABSENCE OF CATWALKS on these Lippmann Belt Conveyors in the Colorado quarry. That's because Life-Sealed Ball Bearing Idlers need no added lubrication or periodic alignment, a tremendous grease and labor saving.



FOR ALL THE FACTS on the complete Lippmann line for pits, mines and quarries write for: Grizzly King Jaw Crushers (Bulletin 1100), Screen-All Vibrating Screens (1200), Pulverizers (1160), Belt Conveyors (1400), Gyro-Name Secondary Crushers, Circuit Rider Self-Propelled Crushing Plants, Portable Washing Plants, Apron Feeders (1450).

**LIPPmann ENGINEERING  
WORKS**

4603 West Mitchell St., Milwaukee 14, Wisconsin

# ITS BACKBONE DEPENDS ON "U. S."

Carrying crushed rock from pit to surge pile, this U. S. Giant Conveyor Belt would soon cause the entire plant to suspend operations if it ever broke down.

But after nearly six years' service, carrying over a million tons a year, the belt is still in first-class condition. The operators expect it to last at least 10 years at full capacity, based on its present performance.

Like all U. S. Rubber Conveyor installations, best results are obtained through close coordinated teamwork between engineers representing the operators, equipment manufacturers, and engineers of United States Rubber Company. This "Three-Way Engineering" is the most successful way to obtain *higher output* at lower costs, whether the installation is large or small, simple or complex.

Today more than ever, profits depend on mechanization. When you replace your present belt, or when you plan a new conveyor system, call in "U. S." engineers. United States Rubber Company, Mechanical Goods Division, Rockefeller Center, New York 20, N. Y.



**U. S. Giant Conveyor Belt works 8-10 hours a day, is expected to carry 10-12 million tons in 10 years' service.**

Discharge occurs 92 feet above surge pile reclaiming tunnel.



PRODUCT OF

**UNITED STATES RUBBER COMPANY**

ROCKEFELLER CENTER • NEW YORK 20, N. Y.

# 20,000 HR. TRAXCAVATOR "Buys" Mate ... Boom Road System Improvement Program

● Jordan Township, Whiteside County, Illinois, put the TRAXCAVATOR at the left to work, in April, 1939. Within 7 years, this machine had loaded over 102,000 cubic yards of gravel. So many other tax-saving, community-aiding jobs were found, it couldn't keep up with needs for its services!

A Diesel mate was bought for this veteran by the township with savings earned. By now, the first unit has operated over 20,000 hours. And the pair keeps on gratifying taxpayers!

They dig and load up to 32,000 (total) yards of road gravel annually. They do special ditch work, excavate for culverts; clear snow; pull hedge; change stream courses; load "borrow" dirt for special purposes; are winter-ready to load skid-proofing materials after sleet storms.

"What gratifies us especially is the variety of work beyond its regular duties this machine has been able to do. Our records show that the average repair expense on our first machine has been less than 15c per hour," states Jordan Township Commissioner R. E. Allison, Sterling, Illinois.

Trackson builds TRAXCAVATORS to turn the traction-harnessed horsepower of "Caterpillar" Diesel Tractors into big yardage production. To match tractor strength and year-resistance, and to provide movers of materials, from shot-rock to city rubbish, with more savings than available elsewhere.

See your Trackson "Caterpillar" Dealer about early delivery of the TRAXCAVATOR size you need, or write to **Trackson Company, Dept. BR10, Milwaukee, Wis.**



Here is the Model T4, today's version of Jordan Township's 20,000-hour TRAXCAVATOR. 4 TRAXCAVATOR Models, to team with D9, D4, D6 and D7 Tractors.

Jordan Township's TRAXCAVATOR team is shown loading earth in Township trucks for special fill purposes. Gravel loading is their main job!



## TRAXCAVATOR

REG. U. S. PAT. OFF.  
**The Original Tractor  
Excavator**

# Do you HANDLE

With the elimination of cloth bags it will pay you again to examine in detail just what a bag of cement really costs you. There's far more than the 30 extra cents a barrel involved. Mechanical conveying of bulk cement from car to bin eliminates all manual handling of cement, and with accurate batch weighing, Erie provides lowest operating costs. We suggest that you calculate your present total bag handling costs by the day, week or month and let Erie Engineers prove the economy and efficiency of a Type M Portable Cement Plant (172 to 600 bbl. sizes) for your set-up.

Write for Bulletin M-3.

## Or FOR MULTI-CARLOAD USERS OF CEMENT

The Erie Line of "L" type semi-portable cement plants is designed for large capacity cement storage and batching. Large size holds up to 3 carloads and an additional 3 carloads storage can be interconnected by the use of ground storage type bins—giving you up to 6 carload capacity at one unloading point. Outline your needs and be sure to have Bulletin L-2 on file.



**ERIE**  
STEEL CONSTRUCTION COMPANY  
702 GEIST ROAD • ERIE, PENNSYLVANIA

# BIG NEWS for haulers of BIG LOADS!

## New Heavy-Duty 4-TON

### DODGE "Job-Rated" TRUCKS

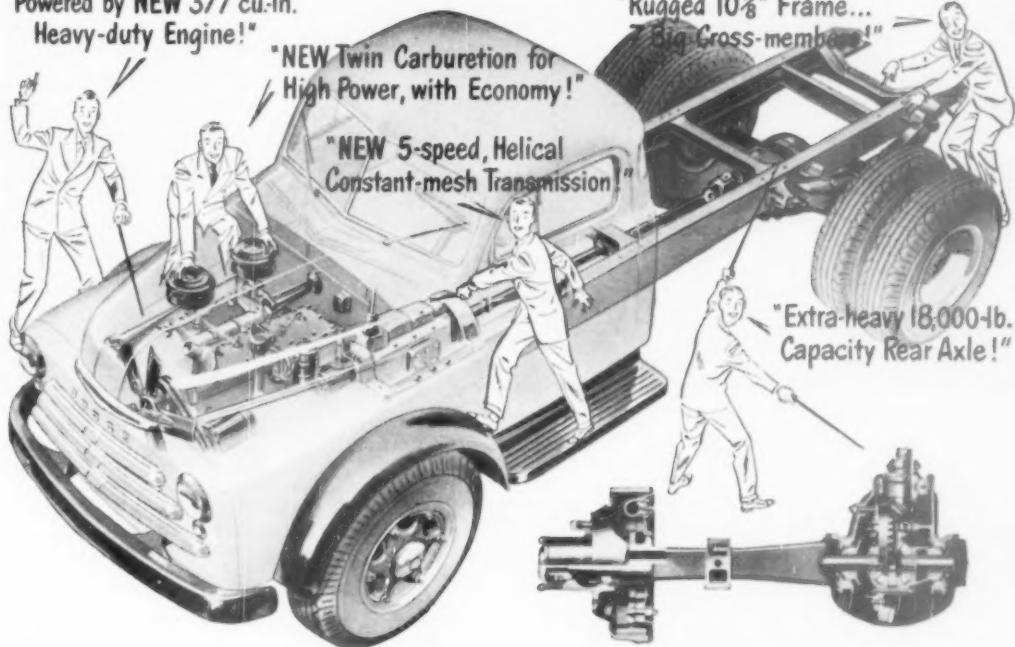
"Powered by NEW 377 cu.in.  
Heavy-duty Engine!"

"NEW Twin Carburetion for  
High Power, with Economy!"

"NEW 5-speed, Helical  
Constant-mesh Transmission!"

"Rugged 10½" Frame...  
7 Big Cross-members!"

"Extra-heavy 18,000-lb.  
Capacity Rear Axle!"



There's a new champion in the HEAVY-DUTY truck field. It's the new Dodge truck rated at 28,000 pounds G.V.W. . . . 50,000 pounds G.C.W.!

Ample "Job-Rated" POWER flows from one of the finest-performing, and most economical truck engines ever designed. It develops 154 gross horsepower, and 330 pound-feet gross torque.

This remarkable engine contains such advanced long-life features as Silchrome intake valves and inserts. Exhaust valves are Stellite-faced and sodium-filled to resist warping, wear longer.

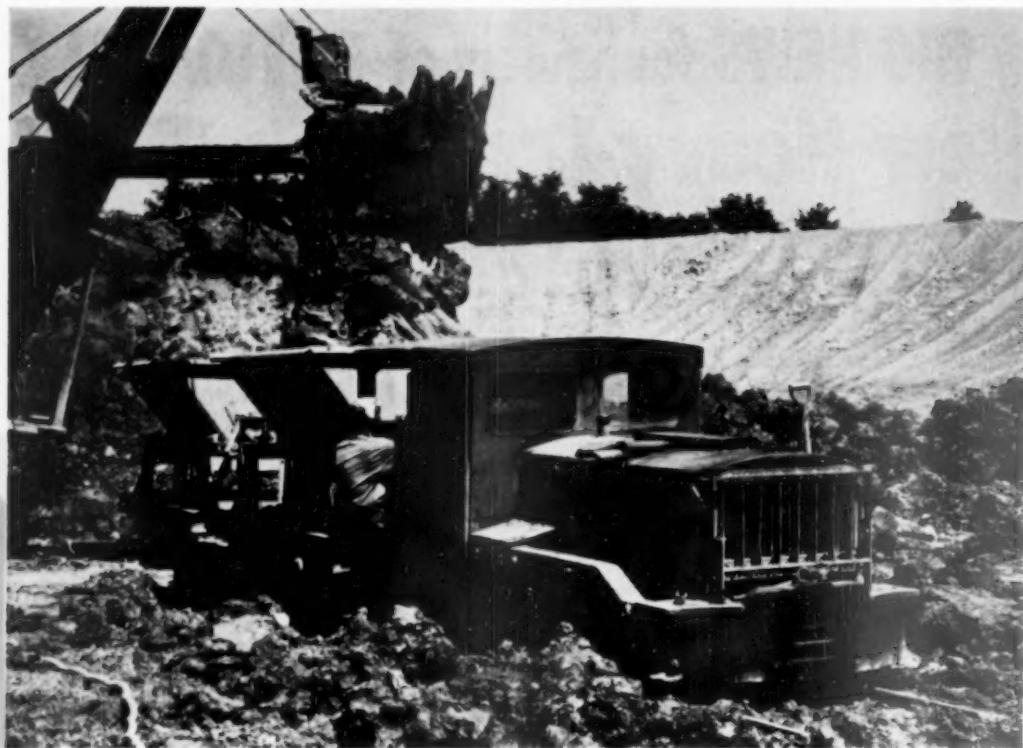
Hydraulic lifters insure perfect valve operation. Rustproof water distributor tube provides maximum valve seat cooling, and lengthens engine life. High power output and economy result from two downdraft carburetors. Features are numerous: Dual intake manifold; dual exhaust system; high anti-vapor-lock pump; ceramic fuel filters; velocity-type governors; oil-bath air cleaners, and many others.

This "Job-Rated" load lugger has a new and rugged constant-mesh, 5-speed helical transmission, direct-in-fifth, with an extremely high torque input. A 5-speed overdrive transmission is available.

This 4-tonner has a rugged 10½-inch frame, with 7 and 8 big crossmembers; extra-heavy 18,000- and 22,000-pound capacity rear axles, and many other HEAVY-DUTY features you'll want to study and compare.

If your transportation requirements fall in the 28,000-pound G.V.W. range (up to 50,000 pounds G.C.W.), we believe you'll find this 4-ton heavyweight your long-awaited answer to . . . lower cost hauling! See your Dodge dealer at your earliest convenience.

For low-cost transportation...switch to  
**DODGE "Job-Rated" TRUCKS**



Over 80 gruelling trips a day — around curves — up grades —  
**THIS PLYMOUTH LOCOMOTIVE CAN TAKE IT!**

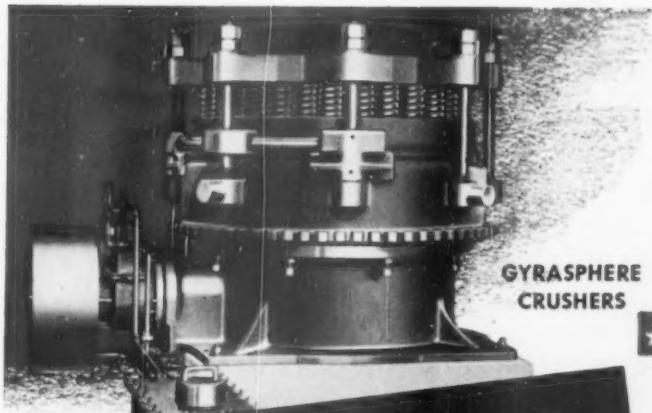
"Four Plymouth Locomotives are doing an outstanding job of hauling clay over a rugged run from our claybanks to our buildings and also hauling brick within our plant," writes C. F. Suderly of the Sutton and Suderly Brick Co., Coeymans, New York.

"This powerful 5-ton, gasoline-powered Plymouth turns in a 48-hour week hauling 210 yards of clay a day up and down a 5% grade around sharp curves over narrow gauge rails. It is a fine piece of machinery, is very economical with fuel, and costs little to maintain.

"The combined service of our four Plymouths adds up to over 50 years; we've found them highly satisfactory — both in service and maintenance."

Unusual? Not at all! Plymouth users in all types of industry under all conditions are enjoying the same Plymouth economy and satisfaction as the Sutton and Suderly Brick Co. There's a Plymouth Locomotive for your job. Write today for information. Plymouth Locomotive Works, Dept. A-5, Plymouth, Ohio.

**PLYMOUTH LOCOMOTIVES**  
**GASOLINE, DIESEL, AND DIESEL ELECTRIC**  
PLYMOUTH LOCOMOTIVE WORKS • Division of The Felt-Root-Heath Co., Plymouth, Ohio, U.S.A.



GYRASPHERE  
CRUSHERS



for  
BETTER PRODUCT • BIGGER CAPACITY  
LOWER COST

What do you want to crush? What size product do you want to make? Coarse... intermediate... fine... or a wide range of sizes? Telsmith Crushers can do it for you—most dependably. You can be sure that Telsmiths will be right for your particular job always. Because Telsmith builds crushers of all types. And Telsmith Engineers have no reason whatever to be prejudiced for or against any one type of crusher. Consult Telsmith Engineers... get their unbiased recommendations for your plant. Find out how the latest features in modern crusher design give you top tonnage, exceptional product quality, low cost... get 40-page Crusher Guide No. 271.

### TELSMITH

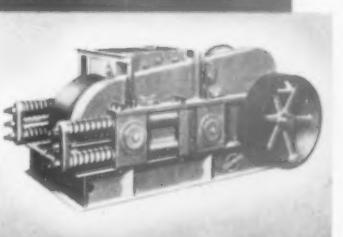
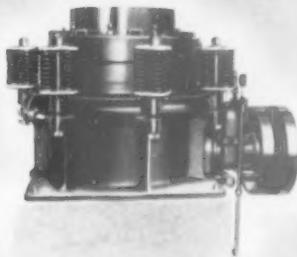
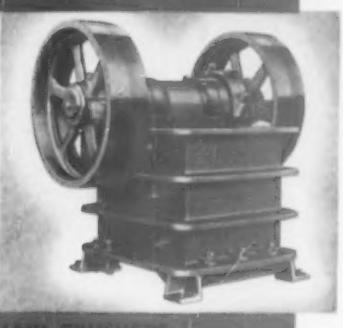
#### PRIMARY CRUSHERS

**Jaw Crushers:** Sizes 10 x 16 in. to 30 x 42 in., 22 to 240 tons per hr. capacity.

**Gyratory Breakers:** Sizes 6-B to 25-B, 26 to 400 tons per hr.

#### SECONDARY CRUSHERS

**Gyrasphere:** Sizes 24 to 48 in., 15 to 210 tons per hr. **Intercone:** Sizes 18 to 28 in., 26 to 68 tons per hr. **Double Roll:** Sizes 24 x 16 in. to 40 x 22 in., 75 to 132 tons per hr.



**SMITH ENGINEERING WORKS, 508 E. CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN**

Cable Address: Songwriter, Milwaukee

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& Seattle 4, Wash.

• Mississ

Co., San Francisco 4, Calif.

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Equipment Co., Statesville, N.C.

• Rich

Egypt Co., Charleston 22, & Clark

Lebanon 5, Ky.

• Richm

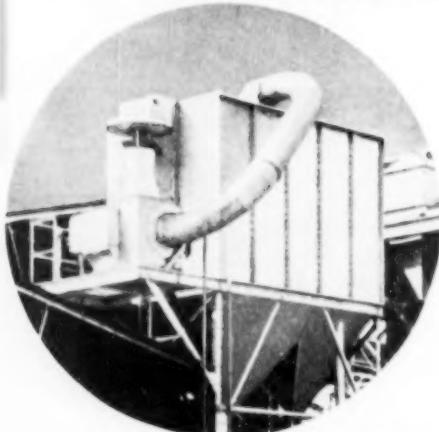
ond 10, Va.

• Wilco

# Norblo



## Automatic Bag Type Dust and Fume Collection



### ★ Rugged

Widely used in zinc, lead, cadmium recovery and other smelting, rock product and mining applications, requiring heavy duty and continuous service.

### ★ Efficient

The multiple cylindrical bag construction with cyclic shaking and cleaning, adjustable for varying dust load without shutting down, has proved its ability to maintain an original, planned efficiency of collection as high as or higher than any other actually attained in practice.

### ★ Economical

Low cost of operation and of maintenance increase the economy of Norblo automatic bag type collection. Where dust salvaged has value, the equipment pays for itself in surprisingly short time. With the increasing necessity to prevent or minimize dust as a part of air pollution Norblo automatic bag type dust arresters offer an essential part of a satisfactory solution. Write for Bulletin No. 164-2.

**The Northern Blower Company**

6408 BARBERTON AVENUE

\*

CLEVELAND 2, OHIO

Automatic and Standard Bag Type Fume and Dust Collectors • Norblo Centrifugal and Hydraulic Collectors • Cement Air Cooling System • Exhaust Fans

# FAST ON THE JOB



## because it's Geared to the Job!

The Model HM like other Payloaders is a better, more productive and more versatile tractor shovel because it is a complete unit-design tractor and shovel. It is NOT a "marriage of convenience" of a shovel attachment to a tractor designed for drawbar work.

Consider just one item — the transmission. The HM Payloader transmission has four forward and four *faster* reverse speeds plus quick, easy, shuttle-action forward-reverse shift. That's an arrangement that spells *speed* on tractor shovel work. It gets into reverse motion fast . . . it backs up faster than it goes forward. It's one *big* reason why Payloaders run rings around tractor shovel attachments having only one slow-speed reverse gear.

Other HM Payloader advantages are four wheel drive on large earthmover tires for *real* traction and flotation, balance and stability, unmatched operator visibility and many others. Get the complete Payloader story from your Hough Distributor today or write The Frank G. Hough Co., 705 Sunnyside Avenue, Libertyville, Ill.

*Send* for catalog covering the big Model HM 1½ yard Payloader or smaller sizes — the 1½ yd. Model H; the ¾ yd. HF; the 12 cu. ft. HA.



**4**  
Wheel Drive

**4**  
Speeds Forward

**4**  
Faster Reverse Speeds

Quick Shuttle-Action Forward-Reverse Shift



**HOUGH**  
**PAYLOADER**  
Manufactured by THE FRANK G. HOUGH CO.



# PRIMACORD makes it easy . . .



You can depend on Primacord to give you sure-fire results when the going gets rough. Branch lines down each hole initiate instantly the entire charge from top to bottom. Problems of deck loading are simplified by the use of Primacord. When you shoot, each charge goes with peak explosive power. You get thorough fragmentation—the kind that keeps big equipment on the move.

Primacord is flexible, easy to handle . . .

it hooks up quickly with simple square knots or half-hitches. It's wound on spools that are a cinch to carry and unreel as loading operations move along. Insensitive to stray currents, it's the logical detonator to use around high-voltage electrical equipment.

There's a grade of Primacord to meet every blasting condition. Ask your explosives supplier; or write us direct. The Ensign-Bickford Co., Simsbury, Connecticut.

p.21

## PRIMACORD-BICKFORD

Detonating  
• Fuse •

# Engineered FROM THE INSIDE OUT

for Higher Output,  
Lower Upkeep!



## Pioneer VIBRATING SCREENS

are made in 3' x 6', 3' x 8', 3' x 10', 4' x 8', 4' x 10', and 4' x 12' sizes with two, three or four decks ... also in tandem.

**BUY BOTH!**

Higher Output,  
Lower Upkeep!

New Booklet!

PIONEER ENGINEERING WORKS  
1515 Central Avenue • Minneapolis 13, Minnesota

Please send me complete information  
about PIONEER Vibrating Screens.

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City \_\_\_\_\_

State \_\_\_\_\_

# Pioneer

*Continuflow* EQUIPMENT

**SINGLE!**  
**DOUBLE!**  
**TRIPLE!**

*Every type of Herringbone  
 Speed Reducer that you might need*

Jones Herringbone Gear Speed Reducers are built in a wide range of ratios and ratings to cover every requirement. Single (Type SH) reducers in standard ratios range from 1.25 to 1 up to 11 to 1 in ratings from 1.3 to 440 H.P. Double (Type DH) reducers are built in standard ratios from 10.9 to 1 up to 72 to 1 in ratings from 0.5 to 275 H.P. The triple reduction reducers (Type TH) cover a range of ratios from 86.9 to 1 up to 355.8 to 1 in ratings from 0.3 to 78 H.P.

All these reducers have heat treated gears, ground shafts and are mounted with anti-friction bearings throughout. Cast iron bases are available for all variations of motor assembly. Liberal stocks are carried to facilitate shipments.



**Here's Complete Information  
 About the Application of  
 Herringbone Reducers**

This 128-page catalog of Jones Herringbone Reducers presents a vast amount of data relating to Herringbone Reduction Units. Illustrations show a broad range of herringbone reducer applications and the technical information shows how to select reducers for all conditions of service in accordance with the A.G.M.A. recommended practice.

*Write for your free copy of this valuable treatise*

**W. A. JONES FOUNDRY & MACHINE CO.**  
 4447 Roosevelt Rd., Chicago 24, Ill.

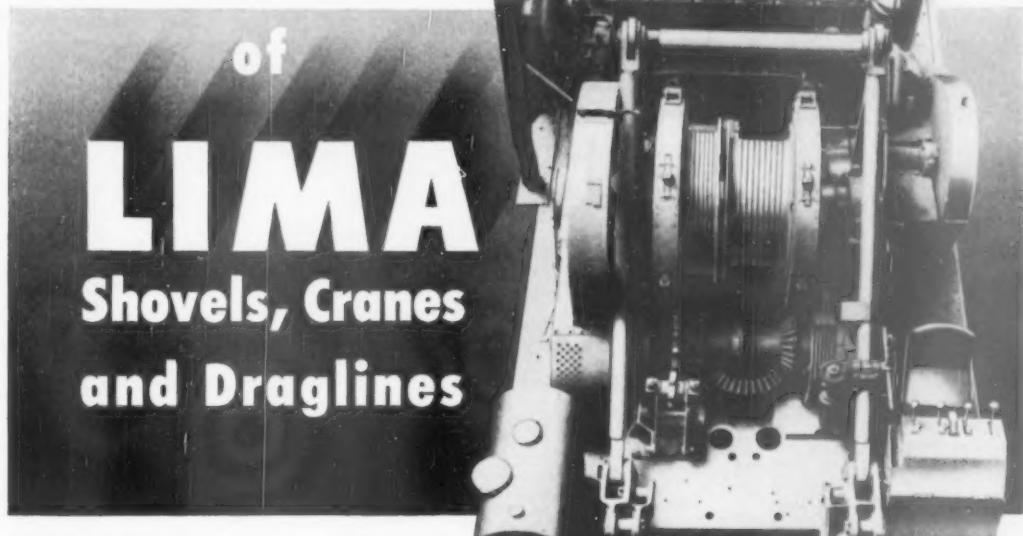
# Jones

HERINGBONE • SPUR • BEVEL • GEAR SPEED REDUCERS  
 PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION  
 FLOW BLOWS • FRICTION CLUTCHES • TORQUE CONVERTERS



Triple Reduction  
 Type TH

# Built-in STAMINA cuts "DOWN-TIME"



## EXAMINE THE MAIN MACHINERY AND YOU'LL UNDERSTAND WHY!

Two LIMA Type 1201 Shovels, equipped with 32½ foot booms, 22 foot dipper handles and 3 yard dippers, loading rock for a crushing plant in Duluth, Minn.



• In this clean-cut design, the fewest possible number of shafts are required to transmit power from engine to dipper. Important bearings, including those in the drum, are anti-friction type. Large drums increase output and minimize cable wear. Permanently aligned shafts prevent chattering and grabbing of clutches. Extra-rugged construction of machinery base, truck and front end equipment provides ample strength to withstand heavy loads. These are only a few of the reasons why LIMA machines are making records of outstanding performance with *minimum down-time*.

The LIMA line includes Shovels to 6 yards, Cranes to 110 tons, and Draglines Variable. Rubber-Mounted units are available with  $\frac{1}{2}$  and 1 yard shovels and 35 ton cranes. Offices in principal cities of the world.

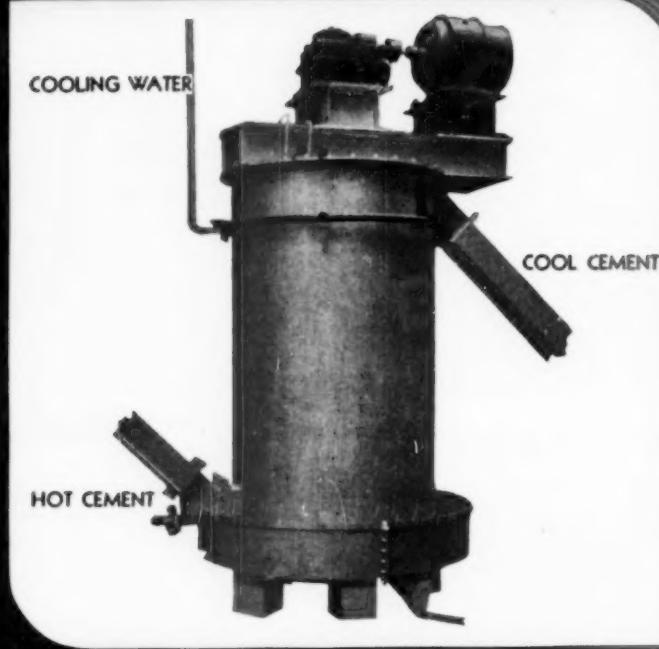
## Lima Shovel and Crane Division

LIMA, OHIO

OTHER DIVISIONS: Lima Locomotive Works Division; Niles Tool Works Co., Heenan, Owens; Rentschler Co.



# FOR COOLING HOT CEMENT



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# "WE HEAR..."

February, 1950

A sharp decline in business plant and equipment spending is predicted for the first quarter of 1950 by the Commerce Department and Securities and Exchange Commission. Plant and equipment spending was \$4460 million in the first quarter of 1949 and estimated at \$4430 million in the last quarter. Estimate for 1950's first quarter is \$3820 million. Spending for manufacturing and mining companies is expected to slide off 18 percent, and for commercial and miscellaneous companies, 12 percent.

\* \* \* \* \*

Proposals on the construction of 3531 multiple-family dwellings, estimated to cost approximately \$38,000,000, at three Alaskan bases, have been requested by the Alaskan Air Command. Construction is scheduled to get under way in April.

\* \* \* \* \*

Illinois farmers buy more limestone and rock phosphate to improve soil fertility than do farmers in any other state, and they rank about tenth in use of mixed fertilizers, according to a report of the Illinois College of Agriculture. Illinois farmers bought 280,000 tons of all kinds of mixed fertilizers and 185,000 tons of rock phosphate in the first six months of 1949. They have been using about 5,250,000 tons of limestone each year since 1940.

\* \* \* \* \*

F. W. Dodge Corp. has reported that contracts awarded for building and engineering works in the 37 states east of the Rocky Mountains last year totaled \$10,359,250,000 to show a gain of 10 percent over 1948 and to establish a new all-time dollar volume contract record.

\* \* \* \* \*

Loadings of railroad freight cars in the first quarter of this year will exceed loadings in the first quarter of 1949 by 2.3 percent, an estimate by the 13 regional shippers advisory boards shows. On a basis of surveys made by the individual boards, they predicted that 6,770,603 cars will be needed to take care of the business in the 32 principal commodity groups against 6,617,580 a year ago. Commodities for which the biggest increases are expected include cement, 3 percent. Decreases are expected in gravel, sand and stone, 4.5 percent.

\* \* \* \* \*

Gross income of Maine turnpike authority reached \$822,163 in the 11 months ended November 30 as compared with \$628,552 in the like period of 1948. After operating expenses the agency had net revenue of \$613,756 compared with \$426,851 in the first 11 months of last year.

\* \* \* \* \*

People working for pay or profit dipped to an average of 58,700,000 in 1949, down 700,000 from the year before. But the number of jobless expanded even more than this would account for--unemployment increased by 1,300,000 persons, to an average of 3,400,000. That was because more people entered the labor force from school or home. This grand total of employed and unemployed rose to a record 62,100,000.

\* \* \* \* \*

Steel operations are expected to boom until midyear, according to Business Week. Inventories of steel were depleted by the strike, but plant slowdowns for want of steel actually are few. Steel demand may quite possibly be back to a normal level by the middle of March.

## WE HEAR

As some readers probably know, a worked-out limestone mine in Kansas now is the store house of the U.S. Department of Agriculture's accumulation of hen's eggs--some two billion of them! The limestone mine, in fact, has had to be enlarged specifically to make more room for more eggs. Some of them have been dried and reduced to powder form, but even then the time is coming, if not already here, when one will need a gas mask to enter, and possibly explosives to remove the fossil remains of unhatched chicks in chambers originally filled with sweet limestone.

\* \* \* \* \*

New capital for construction purposes totaled \$7.3 billion for the year 1949, breaking all previous peacetime records. Most important development during the year in construction financing was the unprecedented volume of state and municipal bond issues for local improvements. Experts see this rising trend in public financing continuing during 1950.

\* \* \* \* \*

A large producer of stoker coal, in an effort to improve the utility of his product, made an investigation to find an additive which would reduce the fusion point of the coal. Through testing it was concluded that hydrated lime accomplished the purpose most satisfactorily and economically, and the firm has produced and is marketing, probably for the first time in history, a "white" coal. However, many homeowners stoutly refuse to purchase the coal which resembles crushed granite. To overcome the prejudice against "white" coal, the firm now is engaged in research to discover another additive which will camouflage the white effect caused by the lime. If this can be done, a large market for hydrated lime should develop. Or, does anyone have any black lime to sell?

\* \* \* \* \*

Present trends indicate that public construction in 1950 will increase approximately \$750 million over the 1949 volume to about \$6 billion. Particular emphasis will be placed on construction of housing, schools, hospitals, highways, sewer and water facilities, and conservation and developmental projects, it is anticipated. An ample supply of building materials, and no particular shortages of skilled manpower also are forecast. Construction costs could average about the same as in 1949.

\* \* \* \* \*

Total poundage of industrial explosives used in the United States reached a new record of 725,227,173 in 1948, or 11 percent greater than the former peak annual consumption in 1947, according to the Bureau of Mines. In the quarrying and nonmetal-mining industries, consumption gained 13 percent over 1947. Use of black powders increased 11 percent in 1948, and use of liquid oxygen explosives in quarrying was reported for the first time.

\* \* \* \* \*

It has been suggested that unused quarries at Brighouse, Yorks., England, be filled in as part of a scheme to beautify the town. There are about 20 such quarries in the district which would be transformed into parks and gardens.

\* \* \* \* \*

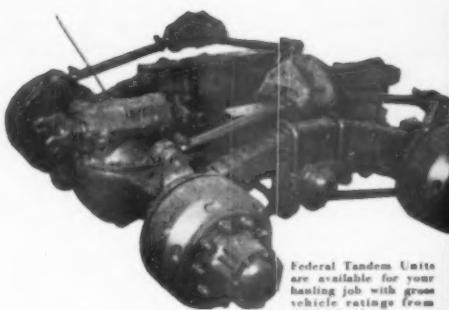
While excavating sand in a pit at Pollington, near Doncaster, England, operators uncovered a stone coffin containing human remains. According to the curator of the local museum, the relic belongs to the Roman period. He placed the remains at about 1500 years old, probably belonging to a rich Roman or British farm owner. The coffin has been reburied for the present.

\* \* \* \* \*

Construction workers scored a gain of about 8 percent in real incomes in the last year. Late figures on hourly earnings show that skilled workers have won increases of 4.9 percent since December, 1948, while unskilled workers have gained 4.6 percent. Meanwhile, the cost of living, as reported by the Bureau of Labor Statistics, is running about 3 percent less than in late 1948. With the boost in wage rates, the average construction worker now is buying about 8 percent more with his hour's pay.

\* \* \* \* \*

THE EDITORS

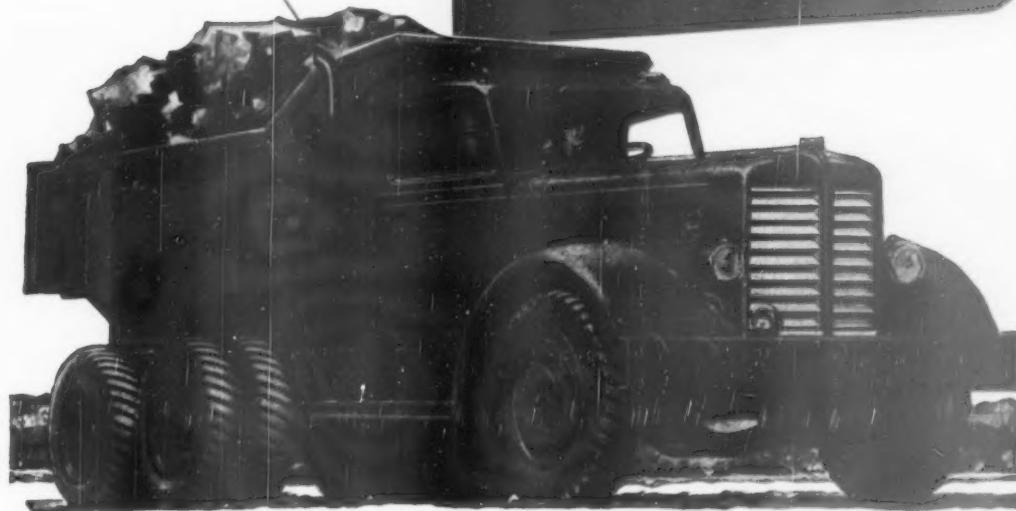


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# Hi-Lift

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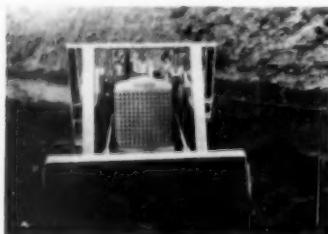
If you're looking for lower cost stripping, here's the answer . . . an Oliver "Cletrac" crawler tractor and Drott Hi-Lift Shovel.

This cost-cutting unit has a wide, deep hydraulically operated bucket that gets a full load every time. The husky power of the Oliver "Cletrac" gives you top crowding action, and the unit bears down and in as it loads. The bucket pivots . . . raising the cutting edge 16 inches . . . on two rugged shoes before lifting, assuring maximum break-out action. The bucket then tilts upward like a shovel for a full bucket every time.

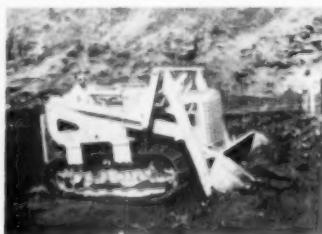
Then, the Hi-Lift takes over. The full 10½-foot lift from the ground to hinge pin of bucket makes loading into trucks up to 8½ feet high, fast and easy. Operator always has maximum visibility for fast operation.

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# Editor's Page

## Economic Growth Without a Hitch!

After reading President Truman's message on The State of the Union and the Annual Economic Review submitted to the president in January by the Council of Economic Advisers, it appears that the goal of the federal government and its economic advisers is perpetual good times through continuous inflation and expansion.

In his message to the Congress, the president foresaw a greatly increased national economy in the immediate years ahead, with substantially increased family incomes, easier work, more generous vacations, larger profits, bigger dividends, protected farm incomes, increased credits and pensions, etc., etc. It's a beautiful picture that was painted and it would be wonderful if all those things could come to happen, but continued deficit spending to accomplish these aims can only mean more inflation and mounting danger of abrupt readjustment, any way you look at it. A lot of idealistic thinking and theorizing cannot remove the upward and downward cycles that have always characterized American business. The best that can be hoped for is that the spreads between highs and lows in our economy be held within reasonable limits, but the very program outlined, which is to do just that, is the main danger we face.

### Economic Highs and Lows

The report of the Council of Economic Advisers, which suggests some policies to follow, is an exhaustive and thorough work but there are weaknesses, at least to us, in the analyses and proposals that would keep the nation expanding its economy so there will be no need of serious depression and unemployment.

For one thing, the authors seem to have built more confidence than is justified in the ability of the nation to control deflationary forces, which is based on the fact that the downward trend early in 1949 was arrested before a serious depression occurred. The most serious factor pointed to in the 1949 decline was failure of demand to grow in proportion to increasing plant output, due to rising prices. That, of course, was correct at the time but the question is whether or not, in the longer pull, actual unfilled demand such as that which still existed in 1949 will continue to always be there to enable having markets for continually increasing output of goods as production continues to expand. That's the way the planners would have it.

There are signs now that that isn't so. We have reached the point where automobiles are being "bootlegged," for example, because franchised

dealers in many areas have more cars than they can sell within reasonable time.

It is recognized in the report that a high level of business investment in plant and equipment is essential to providing prosperity and full employment and that adequate profit is necessary to encourage that objective; yet the high rate of taxation by government is considered unimportant. The planners would hold wages and prices high, and they expect them to remain so, and they believe that business should and can invest in expansion when operating at lower profit margins, if business can visualize an expanding market that will yield a high absolute level of profits.

### Negative Factors

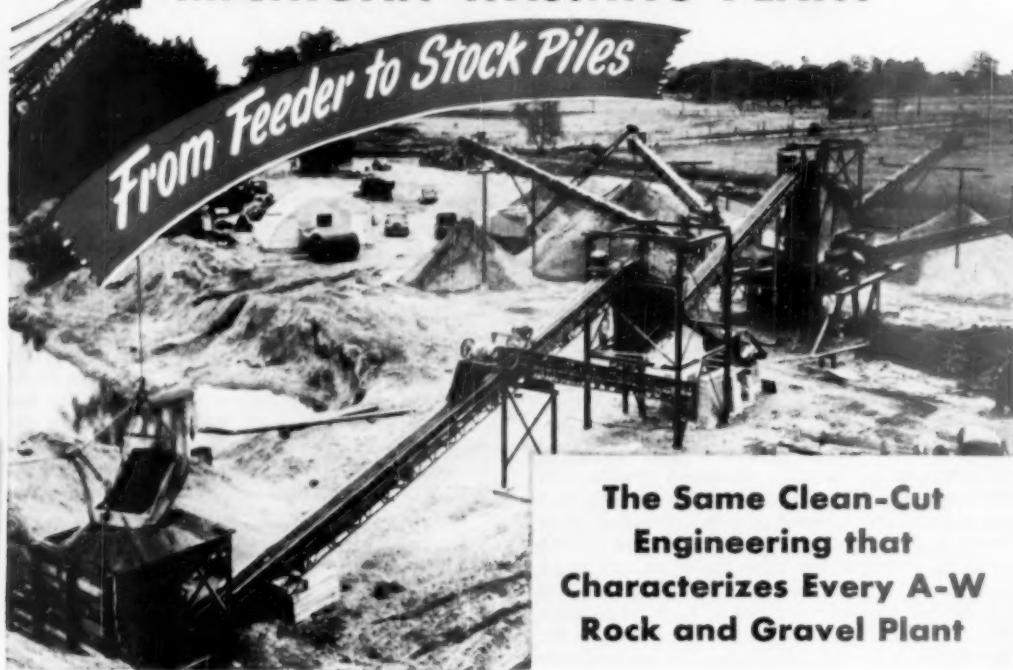
For rebuttal, what about factors that make it impossible to gamble on expanding markets to yield that high absolute profit that is accumulative rather than built on sound unit profit margins? In the aggregates and portland cement industries, for instance, which have had increasing freight rates squeeze their marketing areas into small fractions of what they were, with prospects of still further constriction, it isn't likely that the outlook for long-range market expansion will give incentive to plant expansion, while operating under killing taxes and extraordinary wage levels that threaten profit margins unless *very high levels* of sales can be continued within shrinking marketing areas.

The planners are concerned about savings by individuals and some businesses and would like to see those funds released for risk capital in order to keep the expansion principle rolling. Ever since the beginning of free enterprise, the setting aside of savings has always been fundamental to individuals who would depend upon their own efforts to guarantee their futures.

Keeping supply and demand in perfect balance, as planned, would amount to keeping dollars steadily being turned over by government, business, and individuals. Goods and services would be the measure of well-being and money would only be a tool for manipulation. Prices would stay up, wages would rise with efficiency gains instead of resulting in price reductions and there would be a rising amount of income to be taxed so the government could spend more, and so on and so on.

*Bear Nordberg*

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The plant has facilities which insure the production of properly washed and graded aggregate — a fine and a coarse sand, and two sizes of stone. If desired, additional sizes of product can be made.

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## Modern Political Economy in Practice

WITH DEPARTURE of Dr. Edwin G. Nourse as member and chairman of the Council of Economic Advisors to the President, apparently goes the last bit of influence of what we might call old fashioned economics—the kind of those of us who believed in the infallibility of the law of supply and demand, as we believed in the law of gravity. The two remaining members of the Council are Leon H. Keyserling, acting chairman, and John D. Clark, both graduates of Columbia University, New York City, ex-college professors and learned and experienced in the newer, shall we say, more progressive conceptions of the philosophy of political economy.

The recent annual report of these two economic experts is the first in which they are free to express their convictions without the probably sobering restraint of their older colleague. They were leading lights in the New Deal brain trust, which set out to experiment with revolutionary theories of economics and political economy. They are credited with helping to spark "planned economy" and progress toward socialism and/or communism.

### Business and Government

Having carefully read, and at least partially digested, that part of the report which summarizes their views of the relation of government to free enterprise, or what may be termed the modern conception of political economy, we are inclined to think they have done a creditable job. If all business executives would read and meditate on that portion of the report published in the January 6 issue of *U. S. News and World Report*, we believe there would be more constructive criticism and possibly a better understanding of our present government, provided these economists are sincere in their professions. Regardless of their own prejudices or reactions, business men should read at least this much of the report because it is very evident that it has greatly influenced the President in his conception of the right and wrong of economics in so far as he is guided by an understanding of political economy rather than "politics."

The report presents a conciliatory

approach to business and industry, the most so of any document from the same or similar source in many years. This was also the attitude adopted by the President in his recent messages to Congress, and is doubtless reflected in the recent boom in securities on the New York Stock Exchange. Our bright college boys of 1928 and 1929, have profited by their experience, apparently as much as they say business men have profited by their economic wisdom. For they claim that it was primarily their doing and education of business executives that brought to a speedy end and reversed the recession of early 1949.

The following three paragraphs are significant of the spirit of the report: "Many of our domestic problems revolve around application of moderation, compromise, and reconciliation in defining the respective rights and responsibilities of free enterprise and free government under a popular democracy. There are many ways of stating this root issue. How can enterprise remain free enough to be dynamic without moving from freedom to license? How can government be strong enough, as Lincoln said, to maintain the essential interests of the people without invading their liberties? How can stability be equated with growth? Liberty with law? Individualism with cooperation? How can we steer between the dangers of absolute freedom and the deadliness of absolute security? However put, these questions involve business and government and seek to broaden their areas of agreement and to strengthen their complimentary interactions.

"Nobody can solve this omnipresent issue with a single formula, symbolism, or definition. But there is room for a broad effort to formulate or restate a philosophy of the relationship between business and government. A philosophy voices that agreement on a few fundamentals, alive in the minds of the people, without which there can be little unity or progress. Without universal accord in America about free speech, for example, we could not benefit by debating our disagreements about so many other things. In our economic life no less than our political, there is need for some common philosophy to hold us together . . ."

"Conditioned by the depression era, extremists on the one side have said that our business system broke down through fatal defects and that our government took the whole leadership in putting it together again; while extremists on the other side have blamed government for all the tribulations of business. The new generation of Americans should always remember that the break down resulted from errors on the part of both government and business; that both joined in forging some of the most practical measures for recovery; and that both must admit imperfection because recovery was incomplete until the war restored maximum production and employment."

### Constant Growth

The philosophy of the authors of this report, which they would have us all accept, is that of constant expansion of our producing facilities and accompanying expansion of the consuming capacity of our growing population with their constantly increasing wages or income. It is true that probably the only consistent factor in the economic development of this country hitherto has been this expansion. All that is needed is to make it constant instead of in cycles. Therefore, the authors say, our economy, social theories and practice should be keyed to this factor, so that when we think of the cost of old-age pensions and other social developments of 30 to 50 years hence, we must not be scared but think of them in terms of the expanded economy of that future time, not in terms of our present economy.

Granting the premise of an ever expanding economy, everything can be adjusted by a proper balance of the various elements of growth in the economy as a whole. The report states: "In an expanding economy, the lifting of the low-income families to a far higher standard of living, the improvement of agricultural programs consistent with the needs of urban consumer incomes and also promoting parity of income for the farmer, the provision for adequate funds for a rewarding level of business investment and profits, and the meeting of our domestic welfare and international security requirements, are not incompatible objectives. Attainment of each objective is inseparable from attainment of the others."

In spite of the fact that the authors picture this Utopia within our grasp, they make no reference to the function of money in our economy; its function and value used to be considered important. The report as a whole, and we have only given you a glimpse, is a curious collection of good common sense reasoning and political propaganda. It is mighty interesting reading. Apparently money and money values now and 30 or 50 years from now should be the least of our troubles. Thus we can understand the urge of this generation to convert dollars, as fast as gathered, into tangible goods!



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# LABOR RELATIONS TRENDS

## Details of U. S. Steel's Pension and Welfare Plan

By NATHAN C. ROCKWOOD

ON FEBRUARY 28 the stockholders of the United States Steel Corporation will vote to accept or reject the Pension and Welfare Plan agreement made by the President and Board of Directors of their company with the United Steelworkers (C.I.O.) union, dated November 11, 1949. This is the agreement that ended the strike of several weeks, and was generally acclaimed as a victory for organized labor over the biggest and strongest industrial enterprise in the United States. It is hardly likely that the stockholders will reject this agreement, but the very fact that it is a matter for them finally to decide upon should have a salutary effect on organized labor groups, for it reminds them that it is the stockholders' money which is to be paid out, and the stockholders' equity that will be jeopardized; and there are about as many stockholders (who also have votes) affected as there are employees.

The agreement is divided into four parts: (1) Insurance benefits; (2) Pension benefits; (3) Insurance and pension committee; (4) General provisions. The provisions of the agreement are framed in highly technical, legal language, and probably few of the rank and file of the employees and stockholders are able to understand fully very much of it—and we are not sure we understand it all—but since it sets a precedent that probably all industry will be asked sooner or later to follow, we will do our best to explain some of the details. These do not appear to have been as widely circulated in business publications as one would expect from their importance.

### Insurance Benefits

In effect, the corporation and its subsidiary companies promise employs all the insurance benefits (e.g., death, sickness and accident and hospitalization benefits) that 5¢ per hour worked by employees will buy for each of them individually. The employee is to contribute not to exceed  $2\frac{1}{2}$ c of this and the corporation not to exceed  $2\frac{1}{2}$ c. The exact amounts and the benefits to be provided are left to be determined later by agreement between the company and the union—presumably after they have canvassed the situation with insurance companies to see what can be bought for the set price with the most safety.

Each employee must furnish the company with a written authorization to make the  $2\frac{1}{2}$ c per hour deduction from his paycheck. This insurance plan takes the place of all others now provided by the company except benefits required under the various state laws providing for workmen's com-

pensation and occupational disease. There is an escape clause providing that the company "may cease making deductions from employee earnings in connection with existing plans in which it does not otherwise participate for the same or similar benefit." That means, we take it, that it will not now act as a collection agency for an outside plan of the union or the individual employee.

The insurance benefits provided are intended to take the place of such as may later be required by law, and in that contingency: "Amounts required to be paid by the company or employees either as contributions, taxes or benefits under any law or laws providing non-occupational insurance benefits shall reduce to that extent the amounts the corporation and the employees, respectively, shall be required to pay under Part I of this agreement, and appropriate readjustment shall likewise be made in the benefits." Thus will any future scheme of government "compulsory welfare" be taken care of.

One important provision of the agreement which has received no publicity, apparently, is that any employee who wishes to buy additional benefits over and above those provided for all the employees under the plan, may, with the consent of the union, do so at his own expense; and again with the consent of the employee and the union, the company will agree to make the necessary deduction from the pay check. In other words, there is still an incentive for thrift, with the employee profiting from the lower group insurance costs.

### Pension Benefits

To get minimum pensions of \$100 per month, an employee must have had 25 years of continuous employment with the company, and have attained the age of 65 years. No pensions are provided for employees with less than 15 years of continuous employment after reaching the age of 65. If permanently incapacitated after at least 15 years of continuous service, an employee will become entitled to a pension before reaching the age of 65 years. There are the necessary provisions for determining whether the disability is genuine or not, and there are some kinds of incurred disability which will prevent the employee drawing a pension under this provision. The agreement describes these as: "Incapacity will be deemed to have resulted from an unavoidable cause unless it (1) was contracted, suffered or incurred while the employee was engaged in, or resulted from, his having engaged in a criminal enterprise, or (2) resulted from habitual drunkenness or addiction to narcotics, or (3)

resulted from self-inflicted injury." Also, the agreement exempts the company from paying pensions to permanently disabled veterans of any future war, whose services entitle them to a military pension.

The amount of pension a retiring employee is entitled to is to be figured as follows: "The monthly amount of any pension shall equal one percent of the average monthly earnings of the applicant . . . for services rendered during the 120 calendar months next preceding the month in which the applicant shall retire, multiplied by the number of years of his continuous service." However, there are provisions for taking care of absence from work caused by disability or layoff. If these periods of absence are of more than three consecutive calendar months, "there shall be deducted from the total number of months which shall be used in so computing the average monthly earnings of such employee the aggregate of calendar months in excess of three in each such period of absence." There are supplementary provisions to take care of absences on leave at request of the union for performing union duties.

The minimum pension "to an employee who shall have had at least 25 years of continuous service at the time of his retirement, shall not be at a rate of less than \$1200 per year, and the pension granted to an employee who shall have had 15 years or more, but less than 25, years of continuous service at the time of his retirement, shall not be at a rate per year less than that part of \$1200 which the number of years of his continuous service bears to 25," provided that this rate "shall not be less than \$600 per year until the pensioner shall reach the age of 65 years, after which it shall be not less than the applicable minimum rate as provided in the preceding paragraph." [That is, we believe 15/25ths of \$1200—Editor.]

### Provision for Social Security

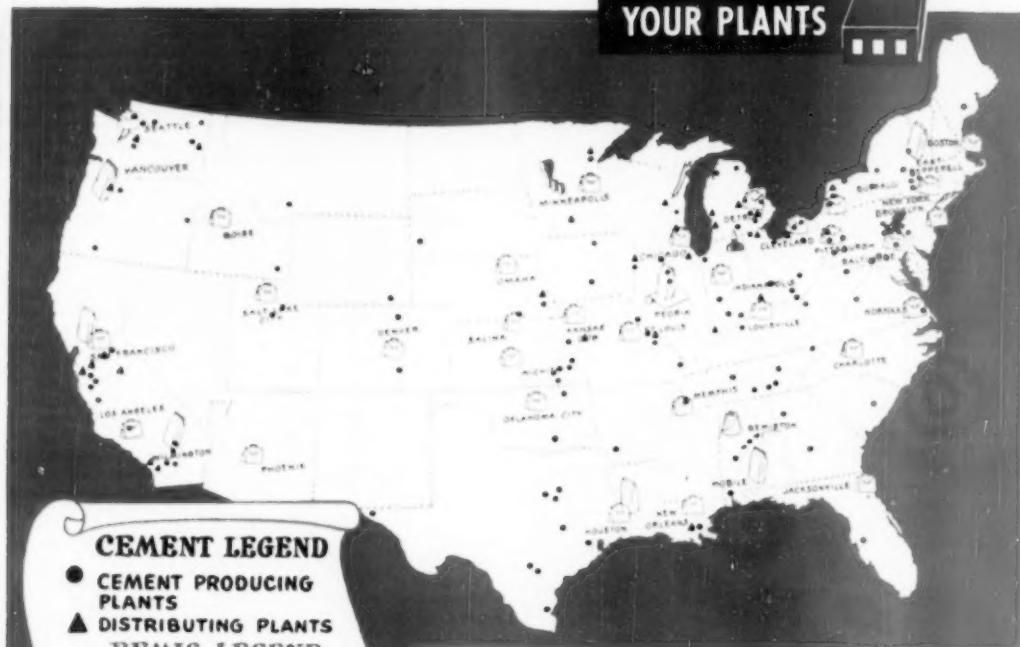
The \$100 a month pension is to be inclusive of any social security pension the employee is entitled to. This is provided for by a long and involved sentence, which states in effect that where any pension is paid an employee under the company plan by the U. S. Government, any state government, foreign government, or other public authority, to which pension payment or fund the company shall have directly or indirectly contributed, then the amount of the pension payable under the company plan shall be reduced by the amount of such pension, provided that if the recipient of the pension has also contributed to the pension fund, the amount of reduction in the company pension will be decreased in proportion. That means, we take it, that in the case of a social security pension, the company will deduct from its pension only that part which represents its own 50 percent

(Continued on page 139)

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Pittsburgh • St. Louis • Salina • Salt Lake City • Seattle • Wichita

# the Personal Side of the news

## Consulting Engineer

RALPH E. GIBBS, York, Penn., has returned to his practice as a consulting chemical engineer specializing in rotary kiln operations. Since 1945 he



Ralph E. Gibbs

has been engaged as research director for York-Shipley, Inc., and has devoted considerable time to writing articles for technical and semi-technical publications. Prior to 1945 Mr. Gibbs was a consultant on many lime and CO<sub>2</sub> recovery projects throughout the country. During this time he worked closely with the late W. R. Cliffe, well-known expert in the lime field. From 1923 to 1942 Mr. Gibbs was chief chemist for the York Corp., and technical director of kiln operations in the field of lime and refractory dolomite manufacture. He graduated from Pennsylvania State College in 1921 with a B.S. degree in electrochemical engineering.

## Production Managers

E. BRADFORD HOLLINGSWORTH, assistant production manager of the National Gypsum Co., Buffalo, N. Y., has been appointed production manager in charge of six plants, and PAUL H. FRETTHOLD, supervisor of plant auditors and cost control, has been named production control manager. A graduate of Carnegie Institute of Technology, Mr. Hollingsworth joined the company in 1935 and worked in various production-line jobs at the Clarence Center, N. Y., plant. In 1938 he was assigned to the Buffalo office as assistant to the controller. Two years later he was transferred to the production department as chief clerk and later became production engineer. In 1945, he was appointed works manager at the York, Penn., lime plant, returning to Buffalo in

1947 as assistant production manager.

Mr. Fretthold became associated with the company on the same day as Mr. Hollingsworth, and worked for three years as inventory clerk in the cost department. He served in the controller's department for ten years as plant auditor and as supervisor of plant auditors and cost control before being appointed production control manager.

## Named President

DR. JOHN W. VANDERWILT, well-known consulting geologist of Denver, has been named president of the Colorado School of Mines, Golden, Colo. He succeeds Dr. Ben H. Parker, who has resigned, effective April 1, to return to the Frontier Refining Co., where he was vice-president at the time he was appointed president of the school in 1946. Dr. Vanderwilt is at present a member of the board of trustees of the School of Mines from which position he has resigned, effective March 20. He was born in Oskaloosa, Iowa, and was graduated from Penn College there. He then attended the University of Michigan where he received a master's degree. In 1927 he received the degree of doctor of philosophy from Harvard University. He has been a consulting geologist for the Climax Molybdenum Co. for some time and has also served on the Board of Experts of the Bureau of Reclamation. In the summer of 1949 he spent three months in Norway doing geologic consulting under the Marshall Plan.



Dr. John W. Vanderwilt

## Sales Representative

CHARLES E. STIVER has been appointed sales representative in southeastern Missouri for Marquette Cement Manufacturing Co., Chicago, Ill.



Charles E. Stiver

He succeeds his father, Chris E. Stiver, who has retired after 25 years of service with the company.

## Directs Research Foundation

VERNON L. MATTSON, chief engineer of the Consolidated Feldspar Corp., Trenton, N. J., has been appointed director of the Colorado School of Mines Research Foundation, according to an announcement by Dr. Ben H. Parker, president of the school and the Foundation's board of trustees. Mr. Mattson, who graduated from the Colorado School of Mines in 1926, has had wide experience in the field of mineral dressing and industrial minerals. The foundation, a non-profit corporation, was organized early in 1949 to provide facilities for and promote research and development in all types of mineral industry work.

## Division Manager

C. RAY WILHELM has been appointed southeastern division manager for the Universal Concrete Pipe Co., Columbus, Ohio, and will have charge of operations in Georgia, Tennessee, Alabama and Florida. He will make his headquarters in Atlanta. Mr. Wilhelm was formerly a machine shop superintendent for the company, and was also in charge of machinery production and sales.

## NEWS

### Research Engineer

JAMES M. RICE has joined the engineering staff of the National Crushed Stone Association, Washington, D. C., as testing and research engineer, as-



James M. Rice

suming the duties formerly performed by J. E. Gray and later by Phillip C. Clarke. Mr. Rice graduated from Purdue University in 1940 with a B.S. degree in public service engineering. During the war, he served four years with the U. S. Army Signal Corps in the Southwest Pacific area, attaining the rank of captain. After his return to civilian life, Mr. Rice continued his studies toward a master's degree in civil engineering at Purdue University, and studied highway engineering under Prof. Kenneth B. Woods, where he became graduate research assistant on the Joint Highway Research Project. During this time he was also on the teaching staff of the School of Civil Engineering in the Materials Testing Laboratory. Prior to joining the N.C.S.A., Mr. Rice was associated with the Walter H. Flood Testing Laboratories, Chicago, Ill., as laboratory assistant and asphalt plant inspector, and later with K. E. McConaughay, Lafayette, Ind., where he specialized in research on the stability and adhesion of asphalt emulsion pavement mixtures. Mr. Rice is a member of the U. S. Corps of Engineers Reserves, a junior member of the American Society of Civil Engineers, and an associate member of the Highway Research Board.

### Regional Director

HEWITT WILSON, technologist and administrator, Bureau of Mines, Norris, Tenn., has been appointed director of Region VII, which comprises the states of Tennessee, North and South Carolina, Georgia, Alabama, Missis-

sippi and Florida. Headquarters for this region has been transferred from Tuscaloosa to Norris, Tenn. Mr. Wilson, who has been with the Bureau since 1920, succeeds J. Bruce Clemmer who is now engaged in metallurgical research in Tucson, Ariz.

### Lime and Cement Firm Reorganized

L. T. McCOURT, president of Fischer Lime and Cement Co., Memphis, Tenn., has been appointed chairman of the board of all of its companies. W. N. FRY, JR., has been named president of Fischer Lime and Cement Co., Greenville Sand and Gravel Co., and Clay Products Corp., and executive vice-president of the Fischer Steel Corp. W. S. WALTERS has been made president of the Fischer Steel Corp. and the Concrete Products Corp., executive vice-president of Fischer Lime and Cement Co., and vice-president of the Greenville Sand and Gravel Co. and Clay Products Corp. J. D. MORAN and W. F. McGEE, SR., have been appointed vice-presidents of Fischer Lime and Cement Co., and TED SAMS has been named vice-president of Fischer Steel Corp. T. L. McREE and C. A. LEWIS, JR., have been named secretary and treasurer and assistant secretary and treasurer, respectively, of all five companies.

In the reorganization, brought about by the termination of the trusteeship set up by the will of the late W. W. Fischer, the physical assets of the Greenville Sand and Gravel Co. were sold to the Greenville Gravel Co. of Greenville, Miss. W. E. McCourt has been named president of this corporation; W. T. Wynn, vice-president, and W. E. McCourt, Jr., secretary and treasurer.



L. T. McCourt

### Assistant Sales Manager

DAVID H. DEACON, sales representative in the Dayton, Ohio, office of the Universal Atlas Cement Co., New York, N. Y., has been appointed assistant sales manager of the Dayton territory. A native of New York City, Mr. Deacon attended New York University and the American Institute of Banking. He was associated with the securities division of the First Boston Corp., New York, for ten years before joining the Universal Atlas Cement Co. in 1941 as a clerk in the Albany, N. Y., sales office. He became a salesman in January, 1942, and two months later joined the U. S. Army Air Force. Commissioned soon thereafter, he was assigned to A.A.F. Intelligence and was honorably discharged as captain in 1946. He rejoined Universal Atlas as sales representative in the Albany office and six months later was assigned to the Dayton sales office as sales representative.

### C.M.M.A. President

L. GLENN SWITZER, Transit Mixed Concrete Co., Pasadena, Calif., has been elected president of the Concrete Masonry Manufacturers Association, Los Angeles, Calif. DAVID W. ECCLES, O'Kelley-Eccles Co., Monrovia, Calif., has been named vice-president, and HOMER C. SHIRLEY, Superior Concrete Block and Builders Supply Co., Temple City, has been made secretary-treasurer. The following members have been elected directors of the Association: E. P. Ripley, General Concrete Products Co., Van Nuys; J. A. Allen, Hollystone Co., North Hollywood; C. D. Wailes, Jr., Wailes-Bageman, Inc., Los Angeles; B. C. Iliff, Pre-Cast Concrete Products Co., Long Beach; Kenneth A. Frederick, Frederick's Cement Block and Building Supply, Culver City; and Merrill E. Bastrup, Upland Concrete Products Co., Upland, Calif.

### In Venezuela

DONALD E. KOCH, formerly vice-president in charge of production at the Harleyville, S. C., plant of Giant Portland Cement Co., Philadelphia, Penn., has been appointed assistant general manager in charge of production for the three plants of C. A. Venezolana de Cementos, Caracas, Venezuela. Mr. Koch is making his headquarters at present in Maracaibo, Estado Zulia, Venezuela.

### Transferred

W. M. LUNAN, superintendent at the Winchester, Mass., plant of The General Crushed Stone Co., Easton, Penn., has been transferred to the stone and bituminous concrete plant at Auburn, N. Y., as superintendent.

## NEWS

### OBITUARIES

HARRY D. JUMPER, chief engineer of Consolidated Rock Products Co., Los Angeles, Calif., died December 19. He was stricken suddenly with a cere-



Harry D. Jumper

bral hemorrhage and died within an hour. He was 53 years old. Mr. Jumper had been associated with the company since 1923 and became chief engineer in 1948. He was also a director of the Saticoy Rock Co., Ventura, and a member of the American Society for Testing Materials and the American Concrete Institute. He was interested in the engineering and research program of the National Sand and Gravel Association and contributed much to the industry in the matter of development of engineering knowledge. Mr. Jumper was mayor of Azusa, his home town, at the time of his death.

THOMAS McCROSKEY, retired manager of the American Limestone Co., Knoxville, Tenn., and pioneer developer and producer of limestone fertilizer, died January 5 in a hospital in Jacksonville, Fla. He was 75 years of age. He and Mrs. McCroskey had been spending the winter months in nearby Atlantic Beach, where they planned to reside permanently, having recently sold their home overlooking Fort Loudoun Lake in Knoxville. As a young man Mr. McCroskey became interested in zinc and lead ore by-products in Joplin, Mo. He established a company there and marketed the tailings or gravel from the mines. In developing processes for making farm fertilizers from limestone, Mr. McCroskey was closely associated with Dr. Harcourt Morgan, retired T.V.A. chairman and former University of Tennessee president, and Dr. Walter MacIntire, chemist at the Agriculture Experiment Station of the university, also Charles M. Seymour, general counsel for the American Zinc Co. Mr. McCroskey became manager of the American Limestone Co. in 1913.

MALCOLM B. COATE, owner and manager of the Arkadelphia Sand and Gravel Co., Arkadelphia, Ark., died December 13. He was 64 years of age. Mr. Coate was also a past president of the Rotary Club. He had been a resident of Arkadelphia since 1935. Previous to that he was in the cotton export business with his father, the late Charles B. Coate, in Sweetwater, Texas, and New Orleans, La.

LOUIS H. MENNE, head of the Quincy Sand Co., Quincy, Ill., died December 14. He was 68 years old. He was head of the Quincy Vitreous Enameling Co. and chairman of the budget committee of the Community Chest for a number of years. Mr. Menne also served as president of the Quincy Chamber of Commerce.

HENRY A. RENINGER, retired director of safety and welfare of the Lehigh Portland Cement Co., Allentown, Penn., passed away December 9. At the time of his retirement in 1946, Mr. Reninger had been with the company for nearly 41 years. He was actively interested in the National Safety Council and was for many years a member of the executive committee. He became a vice-president of the Council and was elected president in 1928. He helped organize the Cement and Quarry Section and served as its chairman from 1921 to 1925. He also served on the accident prevention committee of the Portland Cement Association for 26 years. Mr. Reninger took an active part in the Lehigh Valley Safety Council, serving as a member of the board of directors and as president for several years. He was elected vice-president of the Pennsylvania Society of Safety Engineers and an honorary life member of the American Society of Safety Engineers.



Henry A. Reninger



Thomas A. Hicks

THOMAS A. HICKS, retired general chemist of the Universal Atlas Cement Co., New York, N. Y., passed away December 26 in Sandusky, Ohio, after a short illness. He was 76 years old and had been associated with the company since 1904. Born in Toledo, Ohio, in 1873, Mr. Hicks received his grade and high school education in Sandusky and went to the Case School of Applied Science, Cleveland, from which he graduated in 1896 with a B.S. in chemistry. He began his business career in 1897 when he was appointed chief chemist of the Art Portland Cement Co., Ransom, Ohio. In 1900 he joined the Whitehall Portland Cement Co., Cementon, Penn., in the same capacity, and in 1904 became associated with the Atlas Portland Cement Co. as chief chemist at the Northampton, Penn., plant. He was appointed general chemist for the Atlas company in 1916, and for the Universal Atlas company in 1930. During his 39 years with the company, Mr. Hicks had contributed much to the progress and development of the original plants. He also equipped and assisted in the designing of the modern laboratories at Waco, Texas; Leeds, Ala.; Hudson, N. Y.; and Northampton, Penn.

Mr. Hicks was a member of the American Society for Testing Materials for many years. He had served on Committee C 1 since 1914 and was appointed an honorary member in 1944. He also served on the gypsum committee and was a former member of the textile committee.

RALPH S. QUELLE, former manager of the Linwood Cement Products Co., Davenport, Iowa, died December 28. He was 49 years old. Mr. Quelle was manager of the company from 1920 to 1945. At the time of his death he was purchasing agent of the Innes Co., Bettendorf, Iowa, and a member of the board of directors.

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# INDUSTRY news

## Flotation Plant Ceases Operations

THE FLotation PLANT of the Consolidated Feldspar Corp., Parkdale, Colo., ceased operations on August 1 of the past year. However, selected feldspar from its deposits, located about six miles from the new processing plant, is being ground at Parkdale.

During the short life of the flotation section of the plant, a high grade silica was obtained, but changes in the freight rate structure, development of feldspar sources nearer the Pacific Coast, and other factors are attributed as the reasons for the operation's stoppage. The plant, which represents a considerable investment, is being kept in stand-by condition for the time being.

Headquarters of Consolidated Feldspar Corp. are in Trenton, N. J. R. W. Lawson is president and H. B. DuBois is vice-president in charge of sales.

## Perlite Expansion Plant

OZARK-MAHONING CO., Tulsa, Okla., has constructed and will put into operation soon a plant to expand perlite. The new plant, adjoining the sulfuric and hydrochloric acid plants of the company in West Tulsa, will tend to diversify further the activities of the company. The firm already produces fertilizer, sodium sulfate and fluor spar. The Ozark operation employs a gas-fired rotary kiln, lined with inconel and insulated with perlite. Principal products will be a plaster aggregate of 8 to 10 lb. per cu. ft. density and a concrete aggregate of 15 lb. per cu. ft., both conforming in size to specifications of the American Society for Testing Materials.

## Sand Company Reorganized

BRIDGEPORT CORE SAND CO., Saginaw, Mich., has been reorganized into two separate companies, according to firm officers. Under terms of the dissolution, Ford R. Sargent, F. Roland Sargent and Margaret Sargent will operate the rail sand pits which had been owned by the parent company at Ludington, Vassar, Juniper, and Millington, Mich. They will continue the business under the name of Sargent Sand Co. Fred P. Langschwager, Fred P. Langschwager, Jr., and John H. Langschwager will operate their own industrial sand business under the

name of Saginaw Core Sand Co., using the facilities of the original Bridgeport firm. Officials have stated that the reorganization was made to avoid possible future inheritance tax complications.

## Lime Company Plans Expansion

WHITEROCK QUARRIES, Pleasant Gap, Penn., will construct a complete new lime plant this summer, according to Ray C. Noll, president and general manager, where all types of high quality calcium lime will be made. Expected to cost more than \$300,000, the new plant, consisting of several large buildings, will be a continuous gas-fired type of operation. The company recently began installation of a new crusher at its present plant.

## Gypsum Plant Expansion

UNITED STATES GYPSUM CO. has embarked on a construction program to increase manufacturing facilities at its Sweetwater, Texas plant, which supplies the trade in Houston. The expansion project is expected to be finished by the middle of 1950. The company's plant at Jacksonville, Fla., is to be enlarged also. Completion of this program will make the installation the largest gypsum mill in the Southwest.

## Vermiculite Firm Expands

WESTERN MINERAL PRODUCTS CO., Minneapolis, Minn., processing distributors of Zonolite brand vermiculite insulation products, recently purchased the facilities of Western Vermiculite Co., Denver, Colo. L. J. Venard, president of the Minnesota firm, has announced, Western Vermiculite was one of the pioneer plants in the vermiculite industry, and has operated in the Denver area for more than ten years.

Plans are underway to triple present production of the newly acquired plant by installing entirely new and modern equipment. The modernization also will ensure that the products will conform to specifications of the American Society for Testing Materials and the Vermiculite Institute. Warren Oas has been promoted to district sales manager with headquarters in Denver. Kenneth Kerkling, Denver, will be superintendent of the plant operations.

## Buy Limestone Firm

C & L LIMESTONE CO., La Cygne, Kan., was purchased recently by R. H. Cornelius and R. E. Lewis. The plant will produce limestone for road construction and agricultural purposes.



Gross weight, loaded, of these triple-side-dump trailer trains, operated by Southwestern Portland Cement Co., Los Angeles, Calif., is 111 tons. Up to 65 tons of stone per load are hauled by five units like the one illustrated on the six-mile run between quarry face and rail siding. Average grade for the run is three percent. These units are powered by 200-hp. Cummins super-charged diesel engines mounted on Mack tractors. The latter are equipped with 200-gal. hydrotarders for added braking on the down grade. Round trips, including loading and unloading, take about 25 min.

## NEWS

### Opens Slag Wool Plant

SLOSS-SHEFFIELD STEEL AND IRON CO., Birmingham, Ala., recently put into operation a new plant for manufacturing several types of insulating material from blast furnace slag. The plant consists of two units, one containing a cupola, a blowing chamber, a curing oven and equipment for packaging batts or blankets produced in this operation. The second unit consists of a cupola, blowing chamber, granulator, rotary screen, vacuum pick-up and sacking equipment for producing blowing wool.

Raw materials used in the production of slag wool consist of slag and coke. These raw materials are discharged into the 48-in. dia. cupola by means of a skip hoist. The cupola is equipped with a water jacket over its entire height so that no refractory lining is used except at the bottom. Air is blown through the tuyeres by means of a centrifugal blower.

The stream of molten slag is divided over a water cooled dividing plate into four streams of uniform size. Each stream passes in front of a steam jet, which blows the slag into wool and thence into the blowing chamber. The wool is forced onto a moving conveyor at the bottom of the blowing chamber by means of an induced draft, which also helps to lower the temperature of the wool. The product is next pulverized in the granulator, screened and sacked in multiwall paper sacks holding 40 lb. of wool. Slag wool batts are also produced.

### Truckers Organize to Negotiate Labor Contracts

CONSOLIDATED DUMP TRUCK OPERATORS ASSOCIATION has been organized in Cleveland, Ohio, "to sponsor and further the social, civic and public relations of persons engaged in the dump trucking industry." One of the chief purposes of the organization is to negotiate its own contracts on wages and working conditions with the A. F. of L. Teamsters Union. In the past, the union negotiated solely with the building supply dealers.

### Portable Vermiculite Expanding Furnace

ZONOLITE CO., Chicago, Ill., has developed a portable expanding furnace for use in foreign markets and in domestic markets which do not justify large operations. This development will make possible the processing of vermiculite at the site of very large construction projects. The furnace, weighing 8000 lb., is skid-mounted and can be set up in almost any ordinary building without requiring special ore pits or foundations. It is shipped in four parts which the company claims can be assembled and placed in opera-

tion within 8 hr. The furnace measures 18 ft. 6 in. long, 11 ft. high, and 3 ft. 6 in. wide. The unit, heated by a single domestic-type oil burner, consists of an ore hopper with an electric vibrating feeder, a small elevator, the furnace proper, and an incline drag conveyor which elevates the material to a small bagging hopper.

### Loss of Silica Shipments May Close Railroad Line

MISSOURI PACIFIC RAILROAD has announced that it might have to suspend its White river division in Arkansas if present Wolf Bayou dam plans are completed. The proposed dam would inundate the rich limestone and silica deposits along the division, and loss of the large volume of shipments from that area would cause the railroad to operate the division at a loss, according to P. J. Neff, St. Louis, Mo., president of the railroad. The line presently is shipping out approximately \$2,300,000 of limestone and silica annually from the Batesville area. The Arkansas Resources and Development Commission has intervened, asking the U. S. Engineers to study relocation of the dam.

### Celotex Plans Extensive Merchandising Program

CLOTEX CORP., Chicago, Ill., will continue its extensive advertising campaign in 1950 to stimulate home building. Henry W. Collins, executive vice-president of the corporation, has stated, "Theme of the new campaign, which is to be intensified by the use of color ads, will continue to be 'Now is the Time to Build.' Charts of home designs featured in last year's adver-

tisements in such national magazines as *The Saturday Evening Post*, *Better Homes and Gardens*, *Pathfinder* and *Sunset* were sent to 125,000 interested parties who responded to coupon offers, Mr. Collins said. Celotex also will maintain a comprehensive farm advertising program stressing remodeling and insulation of farm buildings. In addition the advertising program will include a campaign in dealer and builder trade publications designed to tie in national with local advertising.

### Installs Dust Collector

SPOKANE PORTLAND CEMENT CO., Spokane, Wash., has installed a Cottrell Precipitator in its plant to recover dust from stack gases. The precipitator, made by Western Precipitation Co., consists of three sections having a total capacity of approximately 100,000 cu. ft. of gas per minute and is so designed that additional sections can be added easily in the future to handle any plant expansion. The unit will be constructed so that it can be used for other recovery operations in the plant if desired. Gases from one Lepol and one dry process kiln at a temperature of 500 to 550 deg. F. will first be cleaned by mechanical collectors, then sent through the Cottrell for final dust removal. It is expected that the overall recovery will be 99.4 percent of the total dust present.

### Erects Bulk Loading Plant

UNIVERSAL ATLAS CEMENT CO., New York, N. Y., has completed construction of a bulk loading station at the company's Independence, Kans. plant.

## Coming Conventions

February 22-25, 1950—

American Concrete Pipe Association, 42nd Annual Convention, Fairmont Hotel, San Francisco, Calif.

February 27-March 3, 1950—

A. S. T. M. Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Penn.

March 6-9, 1950—

American Road Builders' Association, 47th Annual Meeting, Cincinnati, Ohio.

May 11-13, 1950—

National Lime Association Annual Spring Convention, The Homestead, Hot Springs, Va.

June 26-30, 1950—

A.S.T.M., 53rd Annual Meeting and Exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

July, 1950—

National Slag Association, Mid-Year Meeting, Board of Directors, tentatively set for Buffalo, N. Y.

## Cement Firm Celebrates Silver Anniversary

CALVERAS CEMENT CO., San Francisco, Calif., observed its 25th anniversary on Jan. 13, 1950. During the course of the year the company plans to commemorate several of the important dates of its early history. The firm was incorporated in 1925 for the purpose of developing the newly-discovered limestone deposits in the Mother Lode area of the Sierra Nevada mountains in California. William Wallace Mein founded the company and has continued as president during the quarter century.

Calaveras products are distributed by all leading ready-mixed concrete plants and lumber yards in northern California. The company also supplies many of the huge construction projects in the northern part of the state. These include the Pacific Gas and Electric Co. power projects on the Mokelumne and Feather rivers, the Delta-Mendota and Friant-Kern canals of the U. S. Bureau of Reclamation's Central Valley Project, and numerous freeway and highway relocation jobs. The company's gross sales currently are approaching \$5,000,000 annually.

Additions made to the Calaveras plant at San Andreas since 1945 have almost doubled the pre-war production capacity. Methods of engineering and quarry-reserve control which were introduced 2½ decades ago have been followed carefully throughout the years. Geologists estimate that the company's present quarries contain raw materials for many years of continuous production of high quality cement.

### A.C.P. Funds for 1951

PRESIDENT TRUMAN'S budget message to Congress on January 9 requested authorization of \$285,000,000 for the 1951 Agricultural Conservation Program. Previous amounts authorized were \$150,000,000 for 1948, \$257,043,433 for 1949, and \$285,000,000 for 1950. No difficulty is expected in obtaining the appropriations for the 1950 and 1951 programs. Members of the subcommittee considering the bill are Jamie L. Whitten, (D., Miss.), chairman, William G. Stigler, (D., Okla.), Edward H. Kruse, Jr., (D., Ind.), H. Carl Andersen (E., Minn.) and Walt Horan (R., Wash.).

### California Pumice Operation

SUPERLITE CORP., Phoenix, Ariz., has shipped approximately 500 cars of pumice from its Obsidian Butte deposit near Calipatria, Calif., to the Phoenix processing plant. Construction of a pumice block plant at Calipatria by the corporation soon will allow utilization of the material for the Imperial Valley building industry. The present quarry operation is making use of modern plant equip-



This 45-ton General Electric diesel-electric locomotive operates 104 hr. per week at the Security, Md., plant of North American Cement Co., New York, N. Y. During the day shift the unit switches cars loaded with cement from the pack house to the main line and brings in coal and shale. At night and on Sundays it hauls limestone from quarry to plant. It is said to handle 75 loaded cars per day.

ment, including a  $\frac{3}{4}$ -cu. yd. shovel, 10-cu. yd. Carryall, bulldozers, jaw and roll crushers, and vibrating screens. Products include  $\frac{1}{8}$ - and  $\frac{3}{4}$ -in. screened pumice aggregate. Large boulders up to 2 ft. in diameter are shipped directly to Phoenix for processing into abrasive products. Plant capacity is 50 t.p.h. Morris Buterfield is supervisor of the Calipatria operation.

### Perlite Plant Modernized

PERLITE MANUFACTURING CO., Carnegie, Penn., is undertaking a \$100,000 modernization program covering the installation of conveyor systems, bins, and an additional furnace to process perlite, according to T. C. Ward, president. The new furnace will enable the plant to process two tons of raw perlite per hour. Daily production capacity will be raised to 3600 4-cu. ft. bags, or triple present capacity.

### Recover Silica, Gallium

DEL AND TED DEWEY, Emmett, Idaho, have begun construction on a new plant to be ready in the spring for the processing of high grade silica sand for foundry use. Tests made on the deposit to be worked have indicated a high content of gallium also, a scarce element used in making heat-resistant alloys. The sand contains 0.001 percent gallium, worth about \$100 a ton if recovery were perfect.

### Acquires Quarry

CONCO BUILDING PRODUCTS, INC., Mendota, Ill., has acquired the Schneider Stone Quarry at Lannon, Wis., one of the largest Lannon stone quarries.

### Installs Dust Collectors

PENNSYLVANIA-DIXIE CEMENT CORP. has begun the installation of a series of dust collectors at its Kingsport, Tenn., plant, M. T. O'Connor, plant superintendent, announced. The company is taking these steps to comply with the Kingsport air pollution control ordinance. According to Victor N. Roadstrum, chairman of the Penn-Dixie board of directors, three steps are being taken to comply with the Kingsport air pollution control ordinance. They are: (1) installation of dust collectors on finish mills and mortar auxiliary equipment, (2) installation of dust collectors on the pack-house and raw mills and on the stone, shale and coal dryers in the dryer room, and (3) development of plans for dryer stacks.

### New Gypsum Board Plant

CERTAIN-TEED PRODUCTS CORP. has awarded a contract to Turner Construction Co. to construct the buildings for a new gypsum board plant at Fort Dodge, Iowa, R. G. Lizar, Certain-teed president has announced. Plans call for the erection of five connected buildings to cover 100,170 sq. ft. Work has started on the project and is expected to be completed by June, 1950.

### Open Vermiculite Deposit

GRIDS CREEK VERMICULITE PRODUCTS CO., Hamilton, Mont., has opened a pit in the Bitter Root valley, described as containing estimated reserves of 100,000 tons of vermiculite. A vein about  $1\frac{1}{2}$  miles long and a half mile wide is being worked at present, according to the operators, Robert S. Chamberlain and Clifford Jacobson.

# HINTS and HELPS

PROFIT-MAKING IDEAS DEVELOPED BY OPERATING MEN

## Stone Ladder Construction

STONE ladders, such as the one illustrated, are designed to break the fall of sized aggregate that otherwise would be downgraded due to excess



Typical stone ladder used to reduce breakage in falling stone

breakage at times when the stockpile is low. Such ladders are now in use at many rock products plants. Although they appear simple to design and build, the designer must have an appreciation of the side thrusts that such a column is subjected to when

stone is withdrawn from below, as well as the force exerted by stone falling from pan to pan. When stone is withdrawn from the pile around the base of a stone ladder, it often hangs up and the resultant cave and surge causes a strong side pressure at the base of the column.

In the one illustrated, the pans were too light and the cascading rock tore one from its fastening. If this failure had not been discovered promptly, the plate would have worked its way to the bottom of the pile, possibly closing off a gate over the belt conveyor in the reclaiming tunnel.

## Reversed Generator Polarity

PLANTS using direct current from self-contained power plants frequently experience down time when polarity of the generator is reversed. This occurs most often with compound-wound generators when the tie from generator to bus is made with an existing variation in voltage. With a wiring layout as illustrated, an auxiliary switch in the circuit will correct the reversal of polarity quickly. Note that all regular switches are single pole. To reverse polarity, close the main negative switch on unit No. 2, leaving the other two open, revolve the rheostat to increase the field resistance almost to maximum and close the single-pole, double-throw switch "B" in the upper position for an instant, then open it and throw it in down position. The generator is started then to complete the operation.

If the plant installation is a three-pole unit, Fig. II indicates the type of hookup to install. This involves a

double-pole, double-throw switch with the center points across the shunt fields of the generator.

## Primary Feed Hopper

AT A NEW crushed stone operation in Pennsylvania, the primary crushing unit is a 44- x 32-in. Birdsboro Bucha-



Built-up hopper over primary feeder

nan jaw crusher that is fed by a Teismith apron feeder. Sides of the hopper over the apron feeder have been built up with a series of 12-in. channel irons with the webs bolted together as shown in the illustration. Building up the sides in this manner has enabled the fleet of Mack trucks to dump more easily without having to wait for room, and at the same time ensures a supply of rock ahead of the crusher at all times.

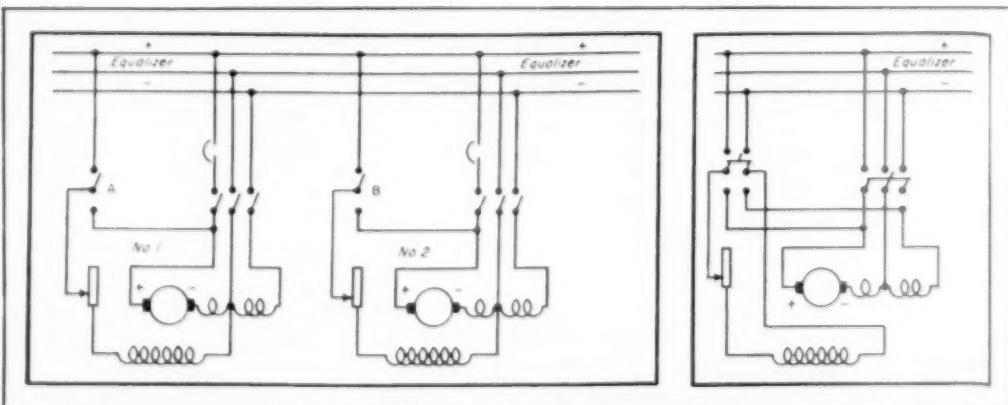


Fig. I, left, illustrates wiring layout for correcting polarity in self-contained, d.c. generator plant. Fig. II, right, covers a three-pole unit

## HINTS AND HELPS

### Sand for Sand-Blasting at Dam Construction Job

A FREQUENTLY overlooked use for sand at a dam construction job is sand blasting. When one considers a



Sand dryer prepares sand-blast material for dam construction

plant processing aggregate and sand for a dam construction job, only that material going into the concrete mix is thought of usually. In pouring the monolithic concrete involved in a dam, the pour is conducted in "lifts," or rectangular blocks. After a lift or block has set, the next upward lift is poured. But, before the green concrete is poured over the previously set material, the older concrete is cleaned thoroughly by sand blast equipment. Sand for this purpose must be dry. Illustrated here is a Blaw-Knox sand dryer installed at a recent dam construction job that is fed by a bucket elevator from a track hopper. After drying, the sand is transferred to a hopper by belt conveyor.

### Tail Pulley Guard

AT A CONCRETE block plant in Washington, gravel is kept out of the tail pulley through the arrangement illustrated. The guard also serves as a



Guard keeps gravel out of tail pulley

safety device by preventing operators from putting hands or fingers in the danger zone. This plant features a series of truck hoppers that deliver to the main belt system serving the plant. Hopper gates are operated by a series of hand levers from a convenient point.

### Aggregate Cooling

HEATING aggregates for winter operation is standard practice at many concrete plants—but cooling aggregates is not so common. At a large dam construction job where it became necessary to cool the aggregates, four large steel silos were provided so that while three were being filled or cooled, material could be drawn from the fourth, thus allowing continuous operation. After a silo was filled, ice water was allowed to flow through the stone for about 30 min., after which material was drawn from the bottom of the silo and transferred by belt conveyor to vibrating screens. The two screens, 5 x 10 ft., were of W. S.



Peripheral discharge rod mill preparing sand for a dam construction job. Note feed chutes delivering material to both ends. Pump, lower center, transfers mill discharge to screening station

mounted in a pit under it. The ground sand and water is delivered to screens by the pump. Throughs from the screens pass to a Dorr bowl-duplex rake classifier for final dewatering.



Four steel silos for ice-water cooling of aggregates. Belt conveyor, center foreground, is for bypassing silos in cold weather

Tyler Co. manufacture, and over each, high-pressure air jets were mounted that were designed to dehydrate the chilled aggregates.

### Installation for Manufacturing Sand

A COMPACT sand preparation station was installed recently at a plant preparing aggregate for a government dam construction project. Principal unit in this section of the plant is a peripheral discharge, 8- x 12-ft. Marcy rod mill. In the illustration it will be noted that two steel chutes serve opposite ends of the mill. These two chutes carry equal amounts of mill feed. Discharge of finished sand from the mill is enclosed in the metal housing around the mill's center. The pulp flows out through ports in the center of the mill to a Wilfley pump

### Mixer Ensures Uniformity

A LARGE plant in one of the major industries of the rock products field uses a small mixer to pre-mix one ingredient of the finished product in order to assure uniformity. As received, the chemical mixture often is not consistent, leading to unequal strengths in the finished product. The engineering staff of this plant therefore designed a 1-ton batch mixer to assure homogeneous mixing of the chemical before its addition to the main plant mix. The device is constructed with six horizontal mixing shafts and a small screw conveyor at the bottom that delivers the mixed material to the service box.



Company-designed batch mixer that ensures uniformity of finished product

# New Machinery

**ROCK  
PRODUCTS**

## Loader-Bulldozer Unit

SOUTHWEST WELDING & MANUFACTURING Co., Alhambra, Calif., designed and is producing a loader-bulldozer unit for attachment to



Interchangeable unit that makes a tractor both a loader and a dozer

crawler-type tractors that can be changed from one operation to the other in as little as 30 min. It is claimed that with one tractor and a minimum number of conversion parts, the operator can have the advantages of both a bulldozer and a bucket loader.

## Single-Phase Capacitor Motor

GENERAL ELECTRIC Co., Schenectady, N. Y., recently introduced a new integral-horsepower capacitor motor for use where power supply demands single-phase operation. This new motor weighs 15 to 20 percent less than the old model. Capacitors are mounted in the base of the motor and there is no conduit box on the side, it having



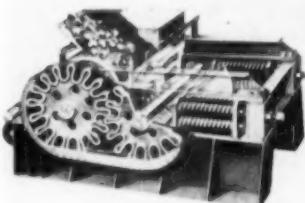
Ratings from  $\frac{1}{2}$  to 5 hp. available in this single-phase capacitor motor

been replaced by a built-in terminal board inside the end shield. These two features minimize over-all dimensions.

These high-torque motors, rated from  $\frac{1}{2}$  to 5 hp., are available in two types: capacitor start and capacitor run. According to G. E. engineers, these motors differ only in starting current, not in output characteristics.

## Improved Roll Crushers

PIONEER ENGINEERING WORKS, INC., Minneapolis, Minn., now offers a number of improvements in its new line of twin and triple roll crushers. The manufacturer states that improvements consist of deeper mounting sills with less obstruction from cross members to provide more clearance for conveyors; a deeper top frame; separately cast star and driving gears; and cast steel hubs for the roll shells. Twin roll crushers are



Cutaway of roll crusher showing gears

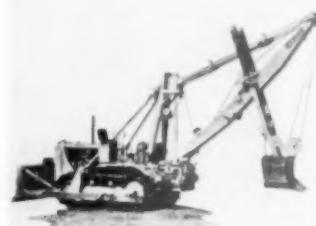
available in sizes 24 x 16, 30 x 18, 40 x 22, and 54 x 24 in. Triple roll crushers are available in sizes 30 x 18 and 40 x 22 in.

## Electronic Combustion Control

WHEELCO INSTRUMENTS Co., Chicago, Ill., has announced the 1300 series Flame-otrol combustion safeguard for industrial and commercial fuel-fired furnaces, ovens, boilers, kilns and other heating equipment. The control uses the flame itself as the "electronic link" in a simple electronic circuit to provide instantaneous switching action, according to the company. It is said to be capable of detecting the presence or absence of a gas or oil flame of any type of burner, and provide a complete self-checking cycle of operation from safe start to safe shut off. The device is approved by both Underwriters' Laboratories and Associated Factory Mutual Laboratories.

## Add Shovel Front

HYSTER Co., Portland, Ore., recently announced that it was adding a shovel front to the complete line of interchangeable Hystaway variations



Shovel front attachment for track-type tractor

adaptable to Caterpillar D7 and D8 track-type tractors. Dipper on this shovel is of  $\frac{1}{2}$ -cu. yd. capacity. Features claimed for this new unit include ample power, fast swing, long reach and absence of tail swing. Other variations of the Hystaway attachment include: crane, dragline, clamshell, trench hoe, bulldozer and pile driver.

## Tractor-Drawn Scraper

WOOLBRIDGE MANUFACTURING Co., Sunnyvale, Calif., is now making deliveries of a new tractor-drawn scraper, Model TC-142, which has been designed to stand up under rugged operating conditions and withstand the heavier stresses imposed by more powerful tractors. The unit is of formed steel construction and has capacities of 14.2 cu. yd. struck, 17.5 heaped.

Other features listed by the manufacturer are a new 3-piece cutting edge for faster loading; wider 65-in. front apron opening and newly designed curved bowl ejector for faster



Scraper featuring 65-in. front apron opening, formed steel construction, 3-piece cutting edge

## NEW MACHINERY

discharge; and high yoke and ground clearance, low center of gravity, short wheel base, and equalized weight distribution for increased stability and maneuverability.

Basic design features of the company line have been maintained such as pivot-tilt forced ejection, rear-draft fulcrum leverage, boiling bowl loading, and replaceable side cutter blades. Overall height with blade on ground is 10 ft., 9 in.; overall width, 11 ft., 6 in. Overall length with pusher is 35 ft., 2 in.

### Redesign 2-cu. yd. Shovel

BUCYRUS-ERIE CO., South Milwaukee, Wis., recently announced production of a new 2-cu. yd. power shovel designated as the 51-R. Convertible in the field for crane, dragline, clamshell or shovel service, the new model will handle 28,000 lb. with a 60-ft. boom at a 30-ft. working radius. For dragline and clamshell service, booms are available in lengths from 50 to 90 ft. and crane booms up to 110 ft. Diesel or electric power is optional.

Main hoist, swing, boom hoist, crowd and retract machinery operate on anti-friction bearings. Conical hook rollers turning in a double flanged track take both upward and downward loads and eliminate use of center pintle. Revolving frame is cast steel. Standard mounting offers users a choice of 20- or 36-in. treads, with longer mountings with 36-in. treads available.

### Variable Speed Drive Control

REEVES PULLEY CO., Columbus, Ind., has developed a hydraulic speed control device for use in conjunction with its Vari-Speed Motodrive. The drive mechanism combines motor, speed changing mechanism and gear reducer in one unit while the control consists of a self-contained hydraulic power plant and a rotary valve, piston and cylinder, mounted on the drive assembly in place of the usual hand wheel. Actuating force of the new



Diesel or electric power plants optional in this new model 2-cu. yd. shovel

control unit is secured by connecting the control valve lever to any speed indicating mechanism on the driven machine. This may be floating roll, follower roll, temperature or pressure indicator, float or moving parts, as pressure of only a few ounces will produce changes in output speeds. The control device is available without the hydraulic power plant where compressed air from some other source is obtainable.

### Heavy-Duty Air Hose

RAYBESTOS-MANHATTAN, INC., Manhattan Rubber Division, Passaic, N. J., has developed the Condor Homo-Flex heavy-duty air hose for use in quarries and mines. Advantages claimed by the manufacturer for this hose in addition to its extreme flexibility are: resistance to kinking; light in weight; practically inseparable cover and plies; wide safety margin on pressure rating; uniform inside and outside diameters; and less elongation and expansion. This hose is available in two sizes,  $\frac{3}{4}$ - and 1-in. I.D., with working pressures of 350 and 300 p.s.i., respectively.

### Improved Truck Line

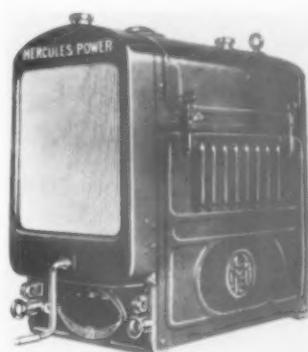
CHEVROLET MOTOR DIVISION, General Motors Corp., Detroit, Mich., has announced its new 1950 line of Chevrolet trucks with increased engine power and added features for driver comfort and safety. Models are available for all types of hauling jobs and comprise 20 series on nine wheel-bases, with a gross vehicle weight range from 4100 to 16,000 lb. The two types of engine available are of 92 and 105 hp., respectively.



Gear reducer and speed-changing mechanism

### Increase Gasoline Power Unit Line by Three Models

HERCULES MOTORS CORP., Canton, Ohio, has added three new models to its line of gasoline power units. All new models are of 4-cylinder design, with model JX4E having  $3\frac{1}{2}$ -in. bore,  $4\frac{1}{4}$ -in. stroke and 164-cu. in. displacement; model JX4C,  $3\frac{1}{2}$ -in. bore,  $4\frac{1}{4}$ -in. stroke and 188-cu. in. displacement; and model JX4D, 4-in. bore,  $4\frac{1}{4}$ -in. stroke and 214-cu. in. displacement. The new models are designed for high-speed, heavy-duty service where portable power plants can be used to advantage. In addition to its line of gasoline power units, the company also produces a line of diesel units with a power range from 12 to 500 hp. in 2-, 4-, 6-, and 8-cylinder models.



Typical unit of three new models of 4-cylinder gasoline power units

## NEW MACHINERY

### Produce Intermediate Crusher

NEW HOLLAND MANUFACTURING CO., Mountville, Penn., has added what it designates as model 4040 Double Impeller



Intermediate model in line of crushers that fill both primary and secondary functions in closed circuit operation

Impeller Breaker to the line of crushers now produced by the company. The new model is designed to meet the needs of operators handling rock larger than the model 3020 can receive, but who do not require a breaker with the capacity of the model 5050. These crushers, which act as both primary and secondary reduction units simultaneously, produce aggregate and agricultural limestone through impact in suspension.

Capacity of the new model is 150 to 250 t.p.h., breaking material to  $2\frac{1}{2}$  in. and minus in a closed circuit from feed that will pass a 40-in. square opening. Rating is based on average Pennsylvania blue limestone. Horsepower required for operation of the mill is 150 to 200, electric, and 220 diesel. Weight of the new model is 65,000 lb. and it measures 17 ft. long by  $11\frac{1}{2}$  ft. high by 8 ft. 4 in. wide. The twin impellers each weigh 7929 lb. and turn on shafts produced from high grade alloy steel. Bearings are self-aligning heavy-duty anti-friction type.

### New Electrode

HOBART BROTHERS CO., Troy, Ohio, has announced a new electrode, Hobart No. 313, which is designed for making short, intermittent welds at high speed on all gauges of steel in any position using either a.c. or d.c. straight or reverse polarity. The electrode is available in 12-in. lengths in  $3/32$  in. only, and 14-in. lengths in  $5/32$  and  $3/16$  in. sizes.

### All-Electric Power Shovel

MARION POWER SHOVEL CO., Marion, Ohio, is in production of a  $3\frac{1}{2}$ -cu. yd., type 111-M, Ward-Leonard all-electric shovel. Boom on this machine is 33 ft. long. One of the first of these shovels to be manufactured is operat-

ing in the Oriskany Falls, New York, quarry, of Eastern Rock Products, Inc.

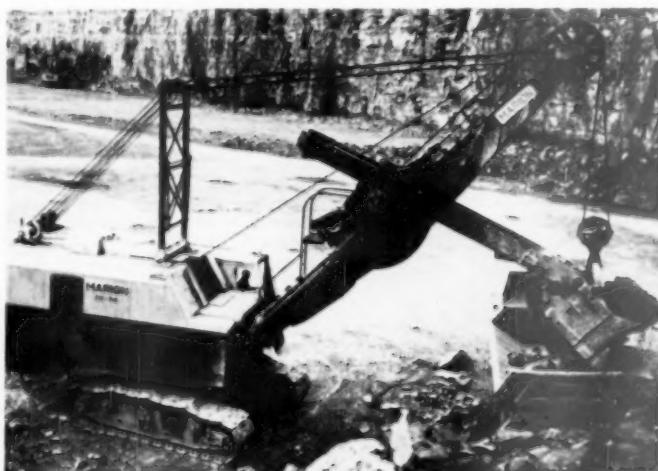
### Replaceable Shovel Teeth

BAER STEEL PRODUCTS, INC., Auburn, Wash., has added replaceable shovel teeth to its line of steel accessories. These teeth have a patented design which is said to triple-lock the teeth to an adapter horn more securely and distribute digging stress over a larger locking area. This locking feature consists of two heavy tongues, top and bottom, which are received by mating slots at the base of the adapter horn. Teeth are wedged to the horn by a tapered pin driven through the assembly and locked by bending its malleable tip into a recess provided for it. Steel used for these teeth, Fibraloy, is reported to be a fibrous metal which permits high



Specially designed replaceable shovel teeth with large locking area

strength and shock-resistant properties at higher hardnesses, with shock resistance remaining high at sub-zero temperatures.



New  $3\frac{1}{2}$ -cu. yd. all-electric power shovel

### Expand Truck Models

DODGE DIVISION, Chrysler Corp., Detroit, Mich., is now in production of a new and expanded line of trucks comprising 356 basic gross vehicle weight models, according to L. L. Colbert, president. The line now ranges from 4250 to 23,000 lb. gross vehicle



Largest model offered in manufacturer's new line has a rating of 23,000 lb. gross vehicle weight

weight and up to 40,000 lb. gross combination weight. Among the new features, according to Mr. Colbert, are: a new electrical system; a 5-speed synchro-shift transmission and a 5-speed synchro-shift overdrive transmission; cyclobonded brake linings; a 37 deg. turning angle and seven different wheelbases, plus one completely new engine.

### Flexible Folding Rule

DURALL TOOL CORP., Yonkers, N. Y., has developed a white enameled 6-ft., zig-zag folding rule made of a special hardened and tempered alloy steel for long wear. The unit, weighing 20 percent less than an average wooden rule, can be bent and twisted in any way, yet always will spring back to its normal shape, the manufacturer reports.

## NEW MACHINERY

### Unit Dries and Sizes Limestone

THE DORR CO., INC., New York, N. Y., is in production of the Fluodry unit, a system for drying and sizing limestone prior to its entering the calciner. This unit, by virtue of the fact that it removes the extremely fine fraction before the material enters the reactor, has materially improved fuel consumption figures. The new device has been proved through its use at the plant of New England Lime Co., Adams, Mass.

The Fluodry system consists essentially of three major parts: 1) a vertical cylindrical sizing compartment, divided into two parts by a horizontal, perforated constriction plate; 2) a dust separation system of one or more cyclones, connecting with the top of the sizing compartment; 3) an air preheater attached to the windbox of the sizing compartment. In operation, the preheated air, passing upwards through the bed of limestone provides the heat necessary to evaporate moisture in the feed, and the rising column of gas carries off fines, which are collected in cyclones. Fines separated from the main body of stone are in the 28- to 100-mesh range.

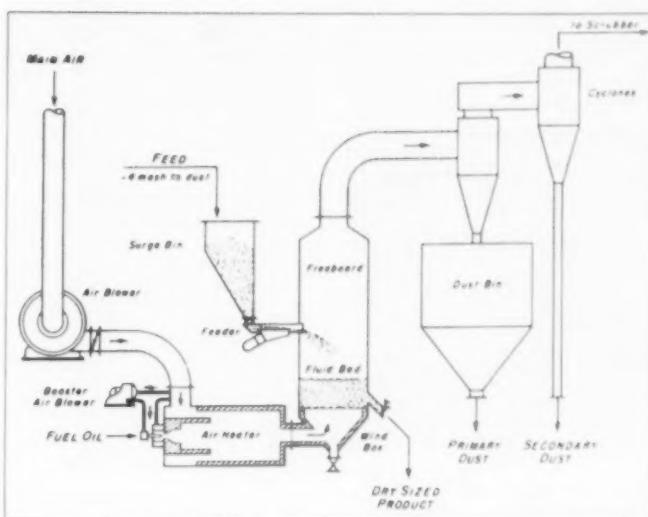
According to the manufacturer, this unit is expected to have general application in the continuous sizing and drying of granular or crystalline materials. Besides limestone it is believed to be equally applicable to dolomite, sands, phosphate, etc.

### Half-Yard Excavator

WAYNE CRANE DIVISION, American Steel Dredge Co., Fort Wayne, Ind., is manufacturing a  $\frac{1}{2}$ -cu. yd., crawler-mounted excavator that is convertible to shovel, trench hoe, dragline, clamshell, magnet or 7.5-ton utility crane. Weight of this unit, when fitted as a trench hoe, is 30,398 lb. Crawler assembly is built completely in the Wayne Crane plant and is powered through direct drive propeller shaft from a newly-designed transmission which is remotely located from the power unit for ease of maintenance. Bearing length of the crawler is 8 ft. 5 in., and width is 8 ft. Added features are 15-in. dia. drums, anti-friction bearings throughout, and all-



Convertible unit for use as trench hoe, shovel, crane or clamshell



Unit to dry granulated material and remove excess fines

welded chassis. The unit travels, lifts, booms and swings simultaneously or independently. Swing speed is 6.2 r.p.m.

### Rubber-Tired Dozer

R. G. LETOURNEAU, INC., Peoria, Ill., has perfected a bulldozer blade that can be attached to model D Roadster Tournapulls. The dozer blade

mounting brackets, and a lunette or clevis-type hitch. Accessories include 11-, 12- or 14-in. brakes, automatic brake control device, and a front third wheel. The axle assemblies are recommended for such applications as transporting generators, welding equipment, concrete mixers, steam cleaners, and field service equipment.

### Safety Treads

NEW PRODUCTS DEVELOPMENT CORP., Schenectady, N. Y., has announced the manufacture of Tigerfoot fall-preventing safety treads. The sandal-like attachments have soles of tough fabric and are easily fitted over and instantly removed from any boot or shoe.



Bulldozer attachment for rubber-tired scraper

is suspended in front of the machine, cable-activated and electrically controlled by a switch mounted on the dash control panel. Bowl length of blade is 6 ft. 8 in., and height of blade and bowl is 32 in. The cutting edge is reversible, with hard-surfaced, replaceable tips, and can be raised 3 ft. above grade level.

### Two-Wheel Single-Axle Assemblies

UNITED MANUFACTURING CO., Bedford, Ohio, is making available Caravan two-wheel single-axle assemblies as complete packaged units. Shipped ready for attachment, these new units have been designed to provide mobility from less than 1000 lb. to more than 7000 lb. Each unit consists of two hub and wheel assemblies, two leaf springs, side-frame or under-frame

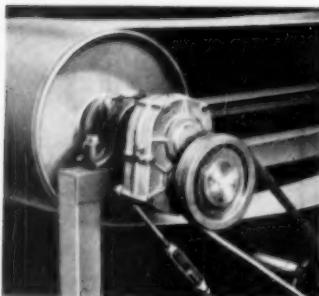


Sandal safety tread

## NEW MACHINERY

### Compact Speed Reducer

DODGE MANUFACTURING CORP., Mishawaka, Ind., has added a new speed reducer to its line of power transmission equipment, to be known as the



Gear speed reducer that mounts directly on drive shaft

**Torque-Arm Speed Reducer.** The new unit mounts directly on the shaft to be driven and is designed as a package that is available from distributors' stocks. It has been designed primarily for conveyors, bucket elevators, agitators, mixers and similar machinery and, according to the manufacturer, the only information required to select the proper size is the horsepower required and the desired speed and the size of the shaft to be driven. Different output speeds can be attained by changing one of the sheaves in the drive.

The machined, cast-iron housing contains a double train of helical steel gears, heat treated and shaved. The unit is locked to the shaft on both sides by steel locking collars. A bushing keyed into the sleeve adapts the sleeve to any desired shaft size. Fixed ratio of the unit is 15:1 and it may be driven by V-belt or flat belt. Through the use of stock sheaves, output speed may be varied from 13 to 133 r.p.m.

### High Power Diesel Crawler Tractors

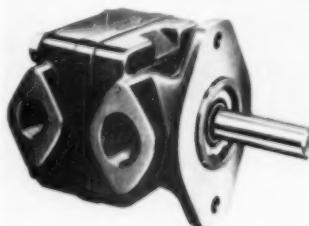
INTERNATIONAL HARVESTER Co., Chicago, Ill., has introduced the TD-14A and TD-18A crawler tractors, more powerful models of the TD-14 and TD-18 units heretofore offered. The TD-18A has 87 drawbar horsepower compared with 80.5 in the previous model. Net engine horsepower at the flywheel, which was 97 in the last model, is now increased to 107. Belt horsepower has been raised from 91.5 to 101. The drawbar has been strengthened by welding and riveting to pull 22,400 lb. in first gear with engine operating at maximum torque. This model has six speeds forward, to a high of 5.7 m.p.h., and two reverse, up to 3.5 m.p.h.

Horsepower of the TD-14A has been increased to 76 at the engine flywheel,

60.5 drawbar, and 72 belt. This tractor has a maximum drawbar pull of 16,600 lb. in first gear and the same speeds as the TD-18A. Both tractors feature spring boosters on the steering clutch hand levers for greater ease of operation, a closed cooling system to prevent loss of coolant on a steep grade, and new lubricating oil filters.

### Vane Pump Designed for Mobile Equipment Industry

VICKERS INC., Division of Sperry Corp., Detroit, Mich., recently designed a new series balanced vane pump expressly designed for the specialized requirements of the mobile equipment industry. A major feature of this new pump is stated to be longer life at maximum efficiency in excess of fixed clearance pumps due to its design that automatically maintains correct radial and axial clearances at all times. An additional feature claimed for this pump is that it automatically



Pump designed to automatically correct radial and axial clearances at all times

adjusts its clearances to oil viscosity variations resulting from temperature changes.

The vane principle provides for no-load starting, which is of importance in cold-weather cranking. Made in four capacities, the V-200 pump operates at pressures up to 1000 p.s.i.

### Splash-Proof Motor

STERLING ELECTRIC MOTORS, INC., Los Angeles, Calif., recently introduced a new design in a splash-proof motor, built for locations which are



Newly designed splash-proof motor of 5 hp. rating

subject to direct streams of water or liquid. The motor, available with feet, footless or flange mounted, may be installed in any position and still retain its splash-proof features. End bells permit free passage of ventilating air through integrally cast baffles, which prevent liquids from reaching the interior of the motor. All bearings are lubricated for life and the motor is produced in a wide range of hp. ratings.

### Pillow Blocks

THE FAFNIR BEARING CO., New Britain, Conn., has developed a series of normal and heavy-duty spherical roller-bearing pillow blocks designed to handle heavy loads over long periods of time with economies in power and maintenance. Available in bore sizes ranging from 2-7/16 in. to approximately 8 in., the pillow blocks are self-aligning, incorporating either felt or triple metallic labyrinth seals.



High power diesel crawler tractor

## NEW MACHINERY

### Perlite Expansion Furnace

PAGE CONVERTER Co., El Monte, Calif., has completed tests and trial runs on its new perlite expansion furnace and is now in production of the unit. Chief advantage claimed by the manufacturer is that the perlite ore at no time comes into direct contact with the flame, thus eliminating explosion and shattering of the particles with resulting dust formation.

The unit consists of a heating chamber within which four stainless steel tubes rotate. The graded ore travels through these tubes. Temperatures are readily controlled between 1600 and 2100 deg. F., as required. Expansion of all ore is claimed to be complete in this machine.

### Shovel-Crane

LINK-BELT SPEEDER CORP., Chicago, Ill., is in production of the most recent addition to its line of shovel-cranes, a  $\frac{1}{2}$ -cu. yd. unit equipped fully with hydraulic controls. This control system, the Speed-O-Matic, is claimed by the company to have been proved in service on  $1\frac{1}{2}$ - to 3-cu. yd. shovels since 1926 and is now being offered for the first time on smaller units.

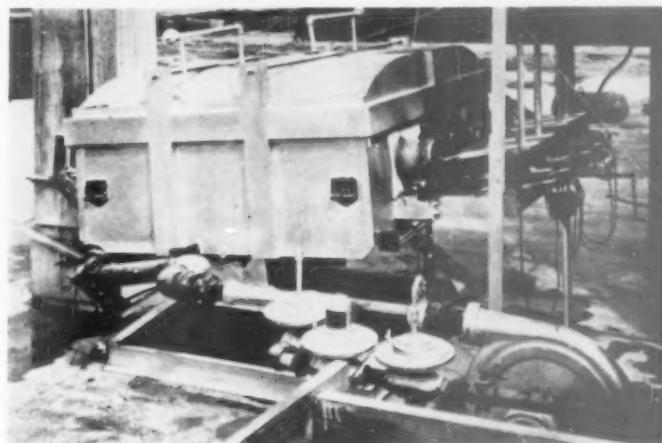
The new machine is fully convertible for operation as a shovel, trench hoe, crane, dragline, clamshell or pile driver. The boom is both raised and lowered under power, and independent travel and swing are available.

### Car Shaker Safety Features

AMERICAN ENGINEERING Co., Philadelphia, Penn., is in production of a new Lo-Head car shaker said to incorporate two safety features due to interlocking controls. These are: the shaker cannot be operated until it is in position, and conversely, the motor trolley cannot be started when the shaker is in operation. This new car shaker is offered in combination with



Newly designed car shaker which incorporates safety features



Compact perlite ore expansion furnace

a 5-ton twin-hook hoist and controls or with a single-hook, 5-ton hoist and controls; or the shaker is available separately for use with existing hoisting equipment.

### Leather Dust Goggle

WILLSON PRODUCTS, INC., Reading, Penn., has brought out an improved leather mask goggle. It is made of



Lightweight goggle mask

high grade, pliable leather which absorbs and distributes impact shock, the firm states. The one-piece elastic headband is adjustable to make the goggle practical for any face or head size. Two styles are available. Style DL31, designed for hot jobs, has deep, well-perforated eye cups to permit air circulation and reduce fogging. Edges are corduroy fabric-bound to absorb perspiration. Style DL48 is indirectly ventilated with two baffled and screened ports on each eye cup and is used especially for dusty jobs. Both models have impact-resistant lenses.

### High-Speed Diesel Engines

CUMMINS ENGINE Co., INC., Columbus, Ind., has designed two new 6-cylinder, high-speed diesel engine models for on- or off-highway automotive application. Both engines have maximum ratings of 175 hp. at 2000 r.p.m. Stated features of these en-

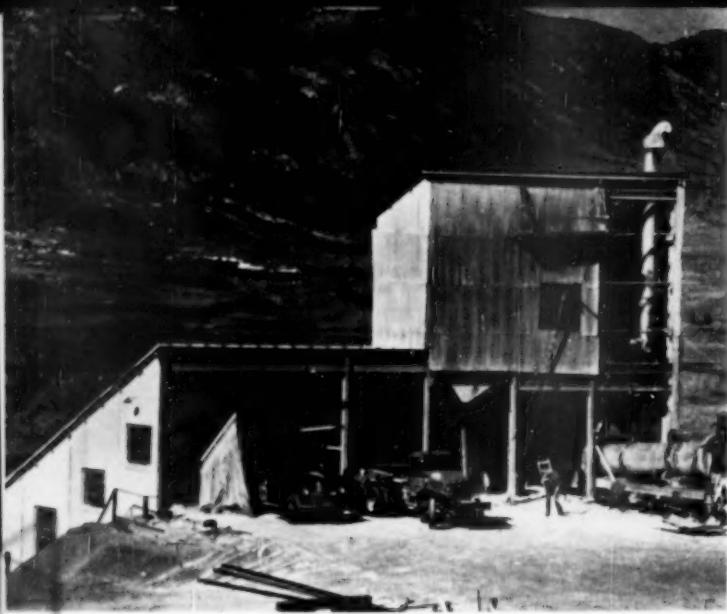
gines are: fully counterbalanced crankshaft; camshaft of new design; viscous-type torsional vibration damper; and revised fuel pump. Both diesels have a piston displacement of 743 cu. in., a  $5\frac{1}{8}$ -in. bore and a 6-in. stroke.

### Forged-Hook Crane Block

AMERICAN HOIST AND DERRICK Co., St. Paul, Minn., has made a new Lo-Head crane block available with capacities from 10 to 50 ton. The block, with its shorter overall length, is said to permit  $1\frac{1}{2}$  to 2 ft. higher lifts without lengthening the boom. The forged hook operates on Timken tapered roller bearings and the cast steel sheaves are equipped with Hyatt Hi-Load bearings. Lubrication, necessary once each 2000 hr., is provided for through Alemite fittings.



Lo-Head crane block with capacities up to 50 ton



Upper level of processing plant in Colorado Springs. Stand-by furnace can be seen at right

**Characteristics of ore in their relation to expansion into lightweight aggregate considered; also factors of classification and furnace operation**

By CLARION W. TAYLOR  
and ROBERT D. WILFLEY\*

## Processing of Perlite Ore

**M**INING OF PERLITE possibly is one of the easiest of mining endeavors. The milling and sizing of perlite, however, has been more difficult and still presents many problems. These problems possibly are true of many new industries, but the rapid and almost

unbelievable acclaim accorded the lightweight aggregates has forced the perlite industry to muster its technical "know how," not only to meet the unsatiated demand for this comparatively new product, but to meet stricter aggregate specifications.

Wind-row stockpiling of crushed and sized ore at mine near Rosita, Colo. This ore is ready for the furnace and will be trucked to nearby railroad spur for shipment to processing plants



Many of the perlite producing companies have been blamed unjustly for not immediately meeting new aggregate specifications. However, several factors, some of which present quite complex problems, enter.

In checking our early day research records it is interesting, but disconcerting, to note that all perlites were generally classified. No attention was given in this classification to the various terms such as dead (or "slow popping") ore, lively (or "fast popping"), nor was any attempt made to determine proper preheat temperatures. In fact, all perlites looked alike, and all were merely crushed to a minus  $\frac{3}{8}$ -in. size and given the same heat treatment. Later our work indicated the necessity of classifying perlite as fast, intermediate, or slow-popping ore.

As technology advanced relative to different sizing and temperature controls, our geologic department retraced many of its steps, and by ore analysis and type classification we found that correct determinative methods gave an impetus to better methods of processing. As an illustration, one ore that originally expanded to an 18-lb. per cu. ft. material was found in proper sizing and heat treatment to produce a 2 lb. per cu. ft. weight.

In the beginning, and in accord with

\*Director of Research and Field Engineer, respectively, Alexite Engineering Division, Alexander Film Co., Colorado Springs, Colo.

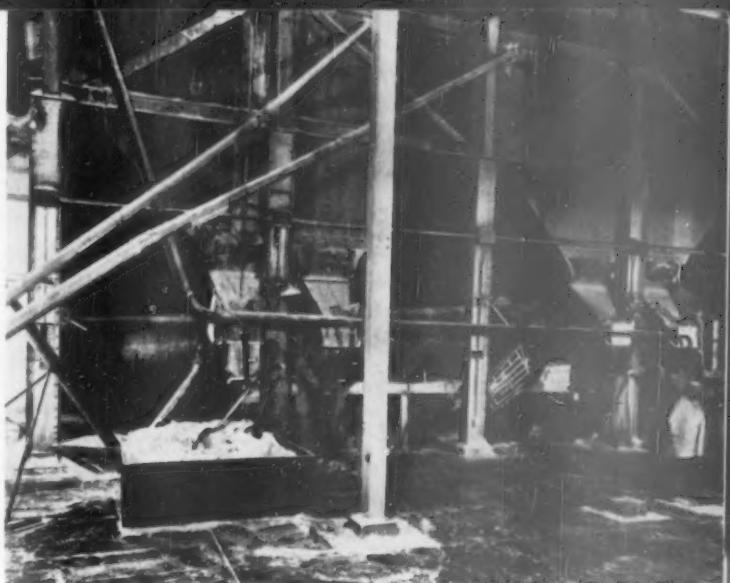
the practice relative to heavier aggregates, raw perlite was merely crushed to pass through a  $\frac{3}{8}$ -in. screen and the resultant product sold to expanders. Furnacing this raw ore, of course, produced an aggregate which was far different from that obtained through the logarithmic grading now advocated by the AleXite Engineering Division. The minus  $\frac{3}{8}$ -in. to pan raw ore that was used originally produced an abundance of minus-100 mesh expanded material. And, while this was a favorable product from the ore producer's standpoint, it resulted in an aggregate totally unlike the sized product of today. Further, it soon was discovered that fines expanded more quickly and that the same furnace retention time for both coarse and fine particles resulted in the larger particles expanding too heavily or the smaller particles fusing to the furnace wall.

Experiments with perlite as a plaster aggregate and the immediate response for perlite in the plaster field naturally demanded an aggregate entirely different from the sizing for concrete. As a result, readjustments in grinding and screening became necessary.

But this is only a portion of the story. At the start, furnace expanders felt that a minus-14 mesh graded perlite raw ore would be correct for producing plaster aggregates. Later this was changed to a minus-20 ore, and still later to a minus 16. On paper this change in sizing appeared to present no problem, but in actual practice the securing of suitable screens, plus adjustment of rolls and rods or other grinding equipment, took time. However, this was not the whole story. After achieving the correct sizing for top fraction, expanders had to determine the correct percentages of in-between meshes. Each new adjustment of the grinding and screening procedure resulted, much to the dismay of the expanders, in increased or decreased amounts of surplus fines. Further, readjustment downward of the top fraction resulted in an increase of fines which had to be eliminated. This condition, in part, resulted in a proportionate loss (increased amount of fines) to the raw ore producer.

In addition to all this, it was found by furnace manufacturers that various furnaces produced different sized particles from identical quantities of head feeds. This occurrence was attributed to different operating temperatures, variations in retention time, quantity of head feed, and other differences in the various furnaces. Further, the development of acoustical aggregates presented additional problems.

Different types of raw ores were found to present individual difficulties, making the situation more unfavorable for the ore producers. Granular ores, breaking easily into individual-



One of the largest perlite expanding furnaces in the world is that of the AleXite Engineering Division. It has a production capacity of 1600 cu. ft. per 8-hr. shift with a head feed of 1 ton per hr. Raw ore is fed into furnace at right; expanded material passes into elevator, left, and is conveyed to a dust removal unit. Material then is air-graded, the different sizes passing into four bins, shown in foreground. From these bins it is bagged in 4-cu. ft. bags.

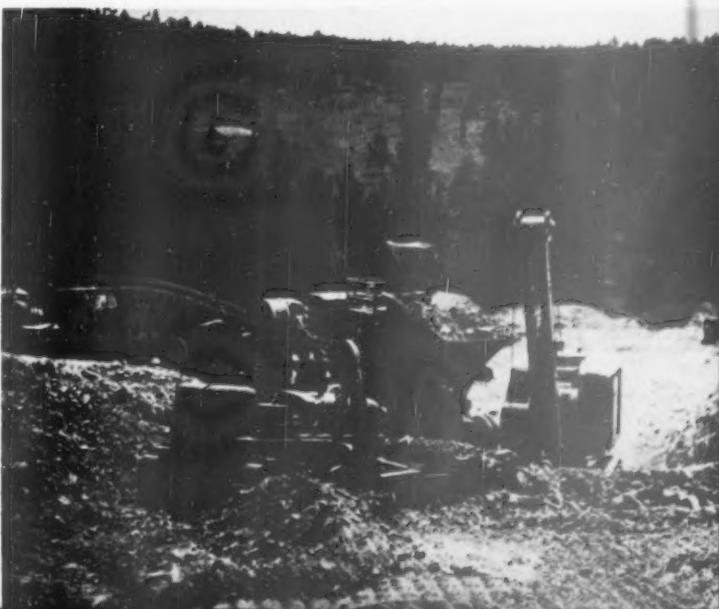
ized grains, could be crushed easily and screened, whereas columnar or splintery structure ores, crushed into spalls which, upon passing through rectangular screen openings, failed to pass specifications in the laboratory screens using square openings.

Not only are there many different structural types of perlite, ranging from lithoid to columnar to granular, and from porphyritic to pumiceous, but frequently these varying types, or a portion of them, are found in the same general deposit or in closely as-

sociated operating areas. No one grinding or screening process, as far as now known, is applicable to the successful and economical processing of all the various types. The five type categories above may be further differentiated into sub-head groups. For example, the granular type may be divided into obicular, spherulitic, etc.

While remarkable advances have been made in furnace technology in the last few years, the fact is apparent that the chief weakness in the industry lies primarily in the incorrect

Perlite surface mining operations. Bulldozer feeds raw ore to diesel shovel which scoops it into portable crushing and screening equipment.





FLOATING A PERLITE CONCRETE ROOF DECK

methods used in grinding and sizing the raw perlite. Certain companies apparently have solved their particular problems with a particular type of perlite, but the fact remains that more technology is desired to fit the correct method to ores of various types. No one method is applicable to all of the structural types for correct processing. It is incumbent upon ore producers and particularly upon grinding and screening equipment companies to achieve a knowledge of the different ore types so that recommendations may be made to the many producers and those hoping to be producers of raw material.

The rapid growth of any new industry presents many problems and the potential volume demand possibly has increased too rapidly for technologists to keep abreast of the marching parade. However, much credit should be given the pioneering companies in this field who, "starting from scratch," have endeavored to meet furnace demands as best they could. One of the larger producing companies, the AleXite Engineering Division, has tried to disseminate information on its findings to all interested perlite producers with the hope of speeding standardization within the perlite industry.

The recent organization of the Perlite Institute on a national scale, with some 60 companies participating, promises much for the future. Practically all of the large perlite companies are represented on the roster, and many smaller companies are destined to take their place in this fast moving industry.

To evaluate a perlite deposit it is important that several factors be given consideration. It is essential that large tonnages of comparatively pure ore be available. The unexpansables (deleterious matter) should not exceed 5 percent. Transportation facili-

ties must be reasonably good. The characteristics of the ore must be determined relative to expansion, temperature ranges, color, and strength of its aggregate. (Consumers in general insist upon white expanded material). Further, the following data should be ascertained relative to the end products, compressive strength, absorption, freezing and thawing, thermal expansion and thermal conductivity.

The deposits of the AleXite Engineering Division near Rosita, Colo., are unusual from the point of view of freight differentials to eastern markets, freedom from excessive overburden, lack of impurities, and unusual toughness of the expanded aggregate.

Field evidence indicates that perlite is an alteration product of volcanic materials. This concept has led our geologic staff to achieve some unusual perlite discoveries.

The mining of perlite has been a relatively cheap and simple operation because virtually all production has been from surface workings, either quarries or open pits. Unconsolidated overburden is removed from the top of the perlite with a bulldozer. Consolidated overburden is drilled and blasted or loaded into trucks and hauled to waste dumps for disposal. The perlite, if too hard to be dug without blasting, is drilled and blasted in a conventional manner. The loose or broken perlite is loaded into trucks or cars by mechanical loaders. At Rosita, the AleXite Engineering Division is using a  $\frac{1}{2}$ -cu. yd. diesel-powered shovel for loading trucks. Double-drum slushers can be used for loading also, and in some workings the broken perlite is moved by bulldozer into a chute leading to a truck. Underground mining practice is similar to that in metal mining.

The preparation of the raw material for furnacing consists essentially in the primary crushing of mine-run or screened perlite, which operation is followed by grinding it in rolls, hammermills, or rod mills in closed circuit with vibrating screens, trommels, and, as in one case, hydroseparators.

#### Crushing and Sizing

Crushing and sizing of AleXite's perlite ore (trade named "PerAleX") at Rosita is done as follows:

The ore is passed into a Cedarapids crusher hopper where it is fed to a jaw crusher and crushed to minus  $1\frac{1}{2}$ -in. size. From there it is conveyed to a 40- x 40-in. roll. The yield from this roll is a two-product material which passes over a 4- x 12-ft. four-deck screen, the plus-8 mesh material to the pan being eliminated at this point to a stock pile, as concrete aggregate. The various decks make it possible to cut or increase different amounts of minus-30 or minus-50 mesh material as desired. The plus-8 mesh material passes through the second roll where it is reduced to either minus-16 or minus-14 mesh material (or desired maximum) and then screened over a 3- x 10-ft. three-deck screen, the end product being plaster aggregate produced at a rate of 36 t.p.h. The minus-30 or minus-50 mesh material, except that portion permitted to pass, is skimmed off the different screens and constitutes the third aggregate known as fines.

F. D. Gustafson, at the mining, milling and processing of perlite conference held during the American Institute of Mining and Metallurgical Engineers meeting, El Paso, Texas, October, 1948, outlined a wet process for the beneficiation of perlite. He states:

"Elimination of as many fines as possible from the final end product is imperative." An outline of his procedure is as follows:

"Primary crusher to storage, then to a 2- x 6-ft. Marcy rod mill for wet grinding at minus-35 percent density. Excessive amounts of water used in the circuit and a 4- x 5-ft. Tyler hummer screen in closed circuit prevents overgrinding of material when down to size. The oversize perlite is pumped back for a regrind by a 2-in. Wemco sand pump; the undersize is passed to a Wemco hydroseparatory where fines are removed."

The AleXite process has been set up to produce and supply correctly sized "furnace-ready" ore to furnace operators. This ore saves users the difficult and expensive task of grinding and screening at the point of expansion and eliminates paying freight on unusable fines.

One of the reasons why this ore has proved very popular is the intrinsic character of the ore itself. PerAleX produces a very tough expanded

(Continued on page 143)

# Classification



Overall view of plant. Rod mill is at extreme left; sand equipment can be seen, center

## Grading of Manufactured Sand

**Milton Grove Sand, Inc., using double-impeller breaker, rod mill, and a sand recovery system consisting of spirals and sand drag in the processing of concrete and masons sand**

LANCASTER COUNTY, PENN., is one of the richest agricultural areas in the United States and when that basic industry is accompanied by a widespread and diversified manufacturing industry, the rock products industries have substantial stake. But rock products industry must have good and cheaply available raw material. Until Milton Grove Sand, Inc., was established, commercial sand, for all practical purposes, was non-existent in the area.

The need for good concrete and masons sand became acute with the activity in eastern Pennsylvania resulting from construction work on the extension of the Pennsylvania Turnpike from Carlisle, (west of Harrisburg) to the suburbs of Philadelphia. The present turnpike connects Carlisle with Pittsburgh, so when the new road is completed the state will be spanned by a high-speed highway connecting the west and east sides of Pennsylvania, and connecting the two major cities of the state. The route is close to the new plant of Milton Grove Sand, Inc.

During the past few years, the production of manufactured sand has grown steadily. The growth has stemmed mainly from the fact that some government agencies have specified that concrete sand should have the

By WALTER B. LENHART

same expansion properties as the coarse aggregate. For example, it has been specified that if granite is the coarse aggregate, granite should be the parent of the sand. Similarly, a dolomite coarse aggregate should re-



H. M. Binkley, president, right, and D. H. Binkley, second vice-president and plant superintendent

quire a dolomitic sand. From another viewpoint, increasing freight rates on a commodity that might require substantial rail haul have stimulated the manufacture of sand from ledge rock or from coarse aggregates. However, in the case of Milton Grove Sand, Inc., the entry of the company into the sand business occurred simply because there was need for it. Modern techniques have proved that processing could be done economically and that manufactured sand could be delivered on a competitive basis both as to price and quality. By taking advantage of the latest developments in crushing, grinding and classification, the company has built and is operating a flexible, yet simple, sand manufacturing plant of high capacity. Milton Grove Sand, Inc., is located at Milton Grove, Penn. This little settlement is a short distance from Highway No. 230 which connects Harrisburg with Lancaster. The plant is roughly 23 miles from Lancaster.

Officers of the company, with headquarters at East Petersburg, Penn., are: H. M. Binkley, president; Ralph Binkley, vice-president; D. H. Binkley, second vice-president and superintendent; Thomas Lalley, secretary-treasurer, and H. Merle Binkley, assistant treasurer.

These men are well known in Penn-

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Two inclined sections of the sand machine house spirals. Concrete sand comes off at the extreme right and is conveyed to the stockpile. The drag produces masons sand. It overflows to tailing pond in launder in foreground.

sylvania and in adjacent areas for they operate affiliated companies under the names of Binkley & Ober, and Binkley Bros., Inc. At East Petersburg, the former affiliate operates a crushed stone plant and a concrete block plant. The operations of Binkley Bros., Inc., include a crushed stone plant and ready-mixed concrete operation at Lititz. The former uses a 50-50 New Holland impact breaker as a part of the quarry operation. Binkley Bros., Inc., also has at Dry Run a plant that produces crushed stone and agricultural limestone; at Newport, a crushed stone operation, and at Oxford, a ready-mixed concrete plant. The main offices of the company are at East Petersburg, and all operations are in Pennsylvania.

### Quarry Operations

The raw material from which sand is manufactured at Milton Grove is a loosely consolidated bedded sandstone. The land previously was farmland and, by removal of a few feet of soil overburden, the sandstone is uncovered. The first cut of about 20 ft. in the pit can, if necessary, be excavated without blasting. But inasmuch as a few churn drill holes will give a high yardage after shooting, the company places a few drill holes using a 22-W Bucyrus-Erie drill rig. The sandstone under the present pit's floor is said to be a little harder and more consolidated than that in the first cut. Loading in the excavation, which is adjacent to the plant and necessitates a haul of only a few hundred feet, is by a No. 604 Lima, 1½-cu. yd. diesel shovel that is equipped with an Electric Steel Foundry bucket. The shovel loads to either of two 5-cu. yd. Koehring Dumptrucks.

The plant is designed for maximum flexibility. At time of inspection in

September, 1949, two sizes of sand, masons and concrete, were being produced. The sand is yellow in color, clean and sharp, and meets all the specifications for the state, county, and urban areas. If these specifications should change in the future, the plant is such that a few simple screen changes or a slight change in grinding practice can be made and the new specifications for size gradation be met. The plant is of steel construction throughout, operates without cover, and is a neat operation with every advantage taken that local topography offers to secure a simple yet efficient plant lay-out. The plant was built by

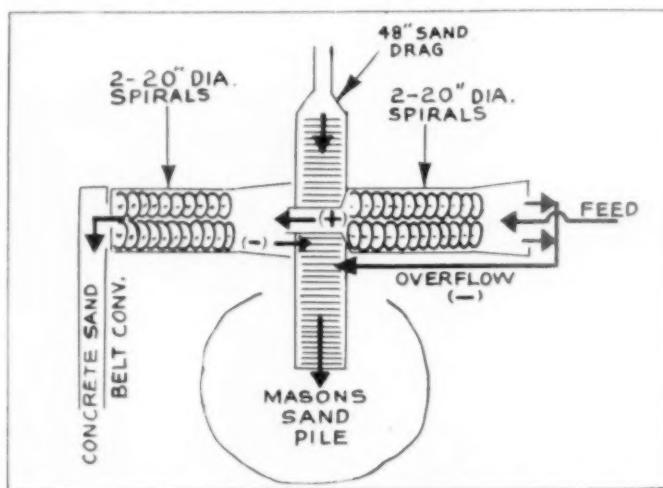
the company in cooperation with A. R. Amos, Jr. of Philadelphia, the designer. Mr. Amos is the Telsmith engineering and sales representative in that section of the country. Barber-Greene supplied the conveyors.

Three of the high points of the operation are, first, the use of a 40-40 New Holland double-impeller breaker as the only crushing unit in the plant; second, the use of a Marcy rod mill for the finish or fine grinding unit; third, the Telsmith sand recovery system. The figures 40-40 on the double impeller breaker indicate the size of the feed opening.

### Crushing

The New Holland impactor, as here used, is an excellent illustration of its simplicity of operation and ease of installation. The unit, with its reciprocating pan feeder, is factory mounted on heavy steel beams so that a simple concrete foundation (or piers) suffices to support it. The two high speed impellers run on roller bearings with each impeller driven through V-belts by a 75-hp. Allis-Chalmers motor. The impellers strike the sandstone chunks, which could be as large as the feed opening, and throw them against breaker bars in such a manner that the discharge product is of pre-determined size. The machine is of rugged construction; dust is not a problem and wear is low. The high speed impellers operate quietly and in this operation one can hardly detect, except for the tonnage pouring through the unit, when the machine is in operation.

The crushed sandstone falls to an inclined belt conveyor and is delivered to a 4-x 12-ft. double-deck, dry,



Details of sand machine. A combination of spirals and a drag prepare the concrete and masons sands.

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vibrating Telsmith scalper screen with any plus material returning to the impact crusher by a return belt. The fines fall to a small surge bin below the screen. The purpose of having a screen here is to ensure flexibility. For instance, it may in the future be desirable to take off a dry sand, or two dry sand sizes. At time of inspection all minus  $\frac{1}{2}$  in. fell into the surge bin and a few plus  $\frac{1}{2}$  in. pieces of sandstone went back up the return belt. The New Holland crusher probably reduced an estimated 95 percent of the total feed in the first pass. The largest pieces returned to the impactor from the screen were in the  $\frac{1}{2}$ - to 1-in. range. The feed opening to the impactor is provided with a mat of vertical chains so that "throw-back" from the impellers is impossible.

### Grinding

The second outstanding feature of the plant is the use of a 5- x 10-ft. peripheral discharge Marcy rod mill as the finish grinding unit. This high-capacity grinding unit consists essentially of a horizontal revolving drum in which are placed many tons of steel rods that are usually 2 to 4 in. in diameter and the same length as the mill. The cascading rods accomplish the grinding and the mill is lined with heavy manganese steel replaceable liners. The mill can operate wet or dry; here it is wet. The capacity of the mill and characteristics of the finished product depend on the type of feed, rod load, amount of water used in the mill, size of the rods in the mill, etc. Here the feed is all minus  $\frac{1}{2}$  in. with high percentage of that material already minus  $\frac{1}{4}$  in. size, but a rod mill can and does handle feed materials up to 3 and 4 in. and at a high rate of capacity. The mill is fed at both ends and discharges through a series of ports in the center periphery of the



In the pit, shovel with 1 1/2-cu. yd. bucket loads to 5-cu. yd. dump truck



Churn drill is used in pit

mill. These ports, roughly 5- x 10-in., extend around the mill. The Milton Grove operators have a  $\frac{3}{8}$ -in. grid of perforated metal. It was indicated that the gride would be removed since the mill operation can be so regulated that no coarse material will get through it.

The minus  $\frac{1}{2}$ -in. sand, in the surge bin previously mentioned, is fed to an inclined belt by a Jeffrey vibrating feeder with rheostat controls near the rod mill so that the operator of the latter mill can quickly change the feed rate to the mill. However, the belt discharges first to a wet, 4- x 12-ft. triple-deck Telsmith vibrating screen. The oversize from that screen falls by gravity to the rod mill. The undersize goes direct to the Telsmith sand machine. The rod mill's discharge flows to this same sand recovery system and the pulp from the rod mill is not rescreened.

The size of the cloth on the upper screen at time of inspection was un-

dergoing experiments, and the exact size that will ultimately be used is a relatively unimportant detail because it might be changed at other operations. The important point here is that the lay-out of the plant is such that the operators can regulate the size of product over a wide range to produce a series of sizes of sand, singly or in a blend.

The rod mill can grind with a thin or a thick pulp. In general, the thinner pulp is flushed through the mill faster so that a coarser grind results.

A thick pulp coats the rods, which do the coarse grinding by cascading action.

Fine grinding occurs by the rolling action of the coated rods, so

that in practice some considerable control can be exercised, as regards fineness specification, by control of

the liquid-to-solid ratio within the



A 4- x 12-ft. double-deck scalper is mounted over the surge bin. Bin is emptied to belt conveyor, right, by a vibrating feeder



Vibrating feeder controls feed to rod mill. Material is minus  $\frac{1}{2}$  in. and minus  $\frac{1}{4}$  in. when it enters the mill

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mill. The mill, when inspected, was carrying a relatively high water content in the pulp.

The rod mill at time of starting was loaded with a mix of 2-in. and 3-in. dia. steel rods. The rod load was such that it gave more capacity than needed, so some of the rods were withdrawn. The standard will probably be about 9 tons of rod in the mill. The rod mill is driven by a 100-hp. Allis-Chalmers motor through V-belt drive. The steel rods used were supplied by the Mine and Smelter Supply Co., manufacturer of the mill.

The rods used in the mill are straight and the steel in them is designed to give high grinding performance per pound of rods consumed. At the same time the rods, after they have worn down to around  $\frac{1}{4}$  in. in diameter, should break rather than bend or snarl within the mill. Some operators prefer to take the rods out when they have worn down to such a small size that their grinding capacity is too low to be economical. As this mill is practically new, no rod or liner wear data are yet available.

### Sand Recovery

A third feature that is unusual is the sand recovery system. The throughs from the screen above the rod mill, and the rod mill discharge, flow to two 20-in. Telsmith sand spirals that are inclined about 30 deg. This set of spirals has a large pool area. The settled materials are wormed up the screw where any adhering clay is loosened by simple attrition of particle rubbing against particle. The mass then discharges through a short

steel launder into a second battery of two 20-in. spirals which likewise have a large pool area. The sand that goes up this last set of spirals is the concrete sand. It falls to a Barber-Greene inclined stacker belt which carries it to ground storage. The overflow from both spirals flows to a 4-ft. sand drag mounted between the two spirals under the high end of the first and at right angles to them. At the time of inspection, the sand drag for the masons sand discharged direct to ground storage, but it was indicated that two slight changes might be added here: a stacker belt for the sand, and additional spiral washers similar to the ones previously described. These are intended to reduce the clay content of the masons sand. The overflow from the sand drag goes to a retaining pond. Some of the water from this pond is reused in the plant with delivery made through a 2-in. Deming pump. The main source of water is from an Allis-Chalmers 800 g.p.m. centrifugal pump. The plant has a capacity of 100 t.p.h. Reclaiming from the ground storage pile is by an LS-51 Link Belt shovel.

### Mortar Tests of Sands

NATIONAL SAND AND GRAVEL ASSOCIATION and NATIONAL READY MIXED CONCRETE ASSOCIATION have published and sent to member companies results of an investigation of variables affecting the validity of A.S.T.M. Method C 87, "Standard Method of Test for Measuring Mortar-Making Properties of Fine Aggregate." This method is widely used in accepting or rejecting sands.

The data contained in the report by Delmar L. Bloem, assistant director of engineering for the two associations, indicate that this method does not provide adequately for isolation of the principal variable which it is intended to measure, namely, effect of organic impurities on strength of mortar. Report concludes that a sand might fail to meet specific requirements with one type of cement and give acceptable results with another.

### New Procedure in Reporting and Paying Payroll Taxes

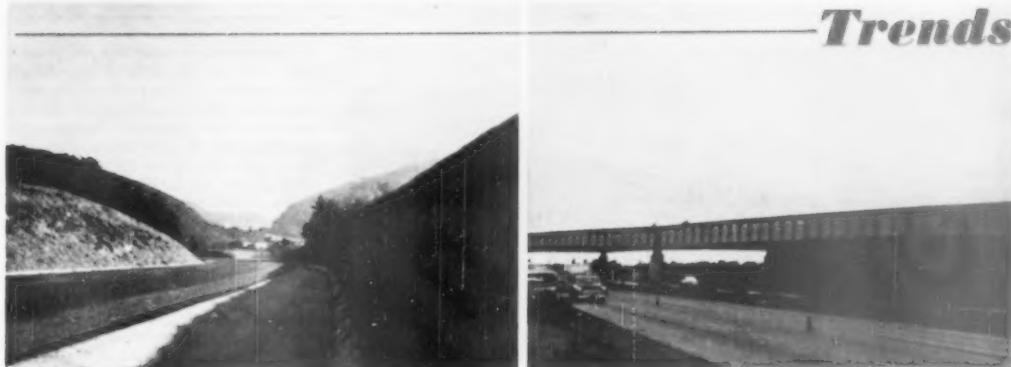
A NEW PROCEDURE for paying and reporting Social Security payroll taxes on wages paid after December 31, 1949, went into effect on January 1, 1950. The depositary system for remitting withheld Federal income taxes was expanded to include Social Security taxes.

Under the new procedure employers are required to deposit the withheld amounts of Federal income taxes and withheld Federal Old Age and Survivors Insurance tax, plus the employer's share of O.A.S.I., in designated banks where the total of both or either of them exceeds \$100.00 in any one month. If less than the stated amount, the employer has the option of making such deposits or remitting the amount quarterly. The new procedure also provides for a new form called Form 941 which will be a combined quarterly return for Social Security withholding plus the employer's O. A. S. I. taxes and Federal income tax withholding. The new form will replace Form SS-1a and W-1 for wages paid after December 31, 1949.



Left: Five- x 10-ft peripheral discharge rod mill. Right: Primary impact crusher driven by two 75-hp. motors





Left: A scenic section of recently completed highway that approaches historic Harper's Ferry. Right: Steel over-pass is a part of the new parkway being built in the state of New Jersey. The road runs north and south from Patterson to Cape May, almost the full length of the state. This photograph was taken near Perth Amboy

## Observations From A Year of Editorial Travel

An editor comments on trends observed in the rock products industries as a result of continuous travel and plant inspections covering these industries coast to coast

By WALTER B. LENHART

the thoughts of one industry and possibly apply them to another.

### Depletion

As one example, we point to recent attempts by the rock products industries to have legislation passed in Washington which would permit depletion benefits with allowances for depletion to be deducted in calculating income taxes. As an example of what is being done, we understand that the first 27 gal. of oil to flow from an oil well is tax-free. The metal miner also has been granted deductions along a similar pattern. These industries have been able to put this over because they have sold the idea that their materials are exhaustible. In casting about to determine the reason why these types of industries have "exhaustible" resources, and why the resources of the rock products industries are considered unlimited, we came upon some basic definitions. Whether intentional or not, the metal miner, possibly centuries ago, divided his raw material into two classifications. Right there he put a limit on their quantities. One he called "ore," the other he called "waste." We have seen several defi-

nitions of "ore" and they all read about as follows: "A material taken from the ground . . . that can be treated at a profit." Those three last words divide his raw material again into more sub-classes. The metal miner may have—and I know from my own experience in mining that he often does have—a very large body of mineral-bearing ground extending for miles in area, and great in depth; however, his basic definition has divided this vast amount of raw material into ore and waste. And, it is not ore unless he can make a profit by treating this rock, although it may even carry appreciable amounts of precious or semi-precious metals.

When we see, at some of the quarries in the rock products industry, stripping of 70 ft. of semi-consolidated overburden to get 21 ft. of rock *ore*, and at other places see the stripping of up to 55 ft. of inferior rock (that must be drilled and blasted) to get to the better rock below, which rock is very limited in thickness, we can see a need for a new definition for crushed stone. Sometime in the not too distant future, operations such as those mentioned will have crossed from the black profit line into the red. For, as truly as economics decide for the metal miner what is *ore*, and what is waste, so do economics

WE OFTEN ARE IMPRESSED with travel articles that appear in the so-called "slick" magazines—the type of thing where a correspondent takes a fast trip, possibly covering one month of travel, then rewards his readers with some such story as "Jim Burke Takes a Look at the West." The reader gets a hop, skip and jump idea of what is going on "Out West," or "Down South." We cannot erect any geographical barriers in our ROCK PRODUCTS travels, for ours collectively is one industry, nor can we hit the high points of this truly giant industry in a few weeks of travel. Perhaps this is a little old fashioned, or slow, but during the past year this one writer was away from his home base 46 continuous weeks which, coupled with travels of the past three years, comprises an inspection trip covering almost 150 weeks of continuous travel. Maybe we have established a record for any trade publication.

In making such a nation-wide trip one gets accustomed to viewing the rock products industries as a spectator who is greatly interested in what is going on in the field, yet is taking no active part in it. And one can sometimes formulate ideas that can be applied to one or more of the industries, not that these ideas are in any way original, but one can borrow



One of the dredges being used to clean up the Schuylkill river near Reading, Penn. Millions of tons of silt, mostly reclaimable fine coal, make up most of the debris. This material later will be treated by flotation, making more anthracite fines available to rotary kiln operators.

decide in the rock products industries which is crushed stone and what is not crushed stone. The difference is that these industries had not seen fit to divide their materials into classifications and to give them distinct names so that each can be identified in the minds of the public, and of Congress, and by the definitions set up in their minds the actual limitations as to the amount available.

There may be other factors in the operation of the rock products industry that may change a producers' material from the category of *ore* to *waste* and thereby limit the size of his ore reserves that can be treated *at a profit*. A sudden change in the freight rate structure can do it. That is happening now. Excessive water coming into a quarry, or pit, possibly from a hidden subterranean channel, may make operations profitless, or the amount of water may increase from year to year and to such an extent that the deposit becomes profitless, exhausted and is abandoned. The sand and gravel industry is particularly vulnerable to changes in specifications. Differences in the expansion properties of the coarse aggregate and the fines may cause rejection. Specifications may enlarge in scope so as to include some "objectionable" mineral as exemplified by the so-called "reactive aggregate," and may affect a producer until affected producers, too, may pass from the black to the red, and the ores become waste and the business exhausted. River dredgers may run into coal seams, or coal intermixed in the deposits being worked. Traffic and navigation accidents have been known to change river gravel from a profitable ore to the status of waste.

Who is there to say that the oil

reserves are exhaustible when one sees the oil shale beds in Colorado, Utah, and Wyoming, which are thousands of feet thick and even miles in thickness, covering thousands and thousands of square miles? There is oil for future generations in billions of barrels that is ore right now if our latest technological information is correct. Where can be shown a rock industry that has a deposit miles thick, and covering practically whole states and which can be mined *at a profit*?

There are oil fields in California and Pennsylvania that have been producing practically ever since there was an oil industry in this country. Who can say with certainty that even these

oil fields are exhaustible, any more than the rock products industries are inexhaustible, and as such should carry more than their fair share of the tax burden of the nation? As we appraise the situation, if taxes are needed, let's have a new deal all around and let each basic industry carry its fair share of the government's expense and not let the rock products industries be the goat.

#### Stream Pollution

We can borrow ideas and methods from other industries having common problems. The metal miner in the western sections has been faced with the problem of keeping sloppy rejects from his processing plant out of the local streams. He has had to do this for three reasons. One is that the rejects or "tailings," as he calls them, may still have values in them and which he hopes to recover some day. Secondly, anti-stream pollution laws have been on the books, and enforced, for many years, in some cases for 25 to 30 years or more. Thirdly, he may want to re-use the tailing water, if he is in a semi-dry area. Thus, from sheer necessity, he has had to devise methods of retaining these rejects. In our December, 1949, issue we reviewed how this was being done in the West, and during the coming year we hope to publish some specific examples with the hope that the information will be of value to those in the rock products industry who now, for the first time, are faced with serious operational difficulties due to the enforcement of anti-stream pollution laws.

The states of New York and Pennsylvania are especially active in efforts to clean up their streams and rivers. Similarly, dust control meas-



Taken near Cornwall, Penn., this photograph shows the eastern leg of the Pennsylvania turnpike. Work on this extension of the new road had been halted temporarily at the time the picture was taken.

ures, smoke and fume abatement, are problems that all communities are facing and acting upon. Industrial cities in the East are not the only ones to have this problem. In one large California city, it was understood that smog conditions were so bad serious consideration was given to closing the public schools because of possible impairment of vision due to eye irritation. We must read the handwriting on the wall, because progress is making these changes a must. They may be unpopular at the moment, but profitable in the long run.

### Safety

We can remember, many years ago, when the general subject of safety was unpopular. We say with some pride that it took some considerable courage for ROCK PRODUCTS, 40 years ago, to promote actively the idea of "Safety First" because many industrialists thought it was a lot of hogwash, and that there was nothing unreasonable about killing a man now and then in the plants. It was part of the business. We can recall that 30 years ago we ran a separate department promoting safety. Members of our staff were pioneers in forming safety organizations that are national and state-wide in scope. In the lush part of the 20's we were even accused of being owned in part by certain sections of the rock products industries because of our zeal in promoting safety in the plants.

We feel that the subject of smoke control, dust abatement, and stream pollution control may be unpopular to some now, but that in the long run (and that is what counts) these controls will prove such a benefit that in the years ahead we will look back and wonder why we ever put up with smog in the first place.

Our travels during the past year have not covered as great an area as in previous years but the rock products industries cannot be classified according to geographical location. Instead, they are grouped to conform to population concentrations and we might say that the number of rock products operations in a given area is directly proportional to its population. When one stops to consider that within the New England states, New York, Pennsylvania, New Jersey, Maryland, and Delaware live some 40 million people, or about 30 percent of our total population, one gets an idea of the concentration of rock products industries within that area. This past year we concentrated on specific areas.

One of the outstanding characteristics of the men in the rock products industries is their friendliness, and if it was not for their whole-hearted cooperation we would be working at a serious disadvantage. The rock products industries, in the national sense, are non-competitive for the most part. The operators on the Atlantic Coast will gladly help their brothers



Alstona dam, north of Atlanta, Ga., during the last stages of construction

on the Pacific, and vice-versa, through a free exchange of ideas. There is no "iron curtain" in the rock products fields. We review the past year of travel with considerable pleasure.

In our many contacts, one of the first questions asked us invariably related to business conditions. Early in the year, it will be recalled, the possibility of a protracted slump was in the minds of most operators. However, it failed to develop. Most of the operators, taking the industry as a whole, did a good volume of business and the year ended with enough business in sight to put them all in an optimistic mood. Early in the year, mainly due to strikes, the foundry, molding sand and glass sand industries had a sharp decline, and they seemed to be working out of it nicely when, towards the close of the year, the steel and coal strikes undoubtedly had some slowing-down effects.

### Road Construction

Taking the rock products industries as a whole, we think the business volume and dollar volume for 1949 will compare quite favorably with any past peak year. For the immediate future in the states we visited, particularly those along the Atlantic seacoast, there is enough business in sight to make 1950 another excellent year. The construction of 4- and 6-lane highways in the East is a development of great importance to producers. The method of financing these projects is mostly through Toll Authorities. These types of roads are coming into being because, in most of these areas, the over-all road picture is not good. In saying this we are comparing general road conditions in the East with road conditions west of the Mississippi river. In one eastern state alone there

are some 40,000 miles of paved roads which we say are mostly bad, not because of any defect in the construction, lack of durability, or what not, but because these roads simply are too narrow, too twisty and too traffic congested. Driving over them for 250 miles is far more tiring than driving twice that distance on most of the roads west of the Mississippi river. The people, and they are the car-owners, are awakening to the fact that faster and better roads are practical and they are going to vote to get them. With more and more automobiles appearing on the highways each year, road builders are going to have to go into high gear, and stay there in order to meet the demands. This, apparently, they all are intending to do.

Happily we found many instances where cities were being by-passed by new road construction even though at fantastic costs per mile. In driving through practically every important city in the United States, generally speaking, the road approaches all are the same, and they, too, are definitely bad. The minute one approaches any large city in the country, he is more or less stalled, and those living in any particular city are inclined to think that their particular city is the worst. If it is any consolation to them, the approaches to any city constitute a driving hazard that we approach with reluctance. It's a big and expensive problem but it is being tackled by most of the communities.

Expressways, such as the turnpikes that span the states, for the most part, are helping to speed up interstate vehicular traffic. The Pennsylvania Turnpike is being extended from both ends. The eastern extension comes close to Philadelphia, but unfortunate-

## TRENDS

ly it ends at a little suburban town some 20-odd miles from the Quaker City. The western leg, in a similar manner, extends across the Ohio state line and it, too, ends at a suburb of Youngstown. In a broad sense, it begins nowhere and ends nowhere and funnels national traffic into areas that are already over congested. The New England states, New Jersey, and Ohio are all very much in the Toll Authority picture with broad construction programs afoot.

We were impressed with the number of times we were stopped in the various states by parties making "traffic surveys." These traffic surveys usually are the forerunners of a change in the traffic status of the section under scrutiny. It was a very hopeful sign. We do hope that within the coming year a uniform, nationwide system of traffic markings and traffic laws will be adopted. As we drive along we often wonder how many lives could be saved by having uniform traffic light locations, uniform heights of traffic lights, uniform street markings, etc.

It is common for producers in the rock products industries in any given section to be intensely interested in activities of producers in distant areas. The eastern operators appear to be just as interested in what is going on "out West" as the Westerner is interested in what is going on "back East." The Easterner is inclined to think that most of the new and larger activities are in the West and the western producer has the opposite picture in his mind. True, in the West we find the big dams and reclamation projects taking up a considerable portion of the limelight, and this editor, after seeing the millions upon millions of people in the East with just about elbow room, seeing them packed in closer and closer each year and with possible restrictions in

opportunities — believes these vast projects in the West to be as essential to our welfare, and possibly more so, than any other single thing in America. For around them revolve conservation of our agricultural resources and future sources of food. Last year, in a travel review, we called attention to the facts relating to population vs. food supply in terms of tillable land and that the population was creeping up on the food supply. From recent information estimates of population growths have been proved to be universally low. Today we have more population than was expected for 1960. As recently as 1945, the Bureau of Census made estimates and by the time this is published those estimates will be 4.5 million short. By 1980 we can be assured that our population will be 175 million and that unless more and more reclamation, conservation, and rehabilitation projects are carried out, our population, according to these authorities, will have exceeded our ability to feed the people. This means that some of our grandchildren could go hungry. Soils are being robbed and impoverished, erosion is taking its toll, and who can tell but that due to repeated croppings for 100 years or more possibly our soil has been depleted of some vital element, mineral or non-mineral that makes our bodies easy prey to cancer. Some universal cause could be responsible for the increasing death rate from cancer.

We have been told that science will make up the soil deficiencies by some mythical pill that will supply us humans with enough, and more energy, with which to work and to live, but so far these have not been developed. It was only a few short years ago that science said that the concrete block industry would be rocked on its heels by plastic homes, but in all our travels over the past 30 years, we have not yet seen a plastic house. So, we should

not be deluded with visions of our food supply coming from anything but the soil, or agencies related thereto. Our state and national associations, both in the agricultural limestone and in the slag fields, are doing good work in pointing out the necessity for returning minerals to the soil. We are inclined to think that such fines as granite screenings, or those from trap rock plants have importance in any soil conservation program, for in these types of rocks there can be trace minerals which are of vital importance to all of us.

Everyone seems to be yelling for a reduction in the spending of the federal government but, at the same time, all are trying to get their feet in the public hog trough by insisting that their particular project is essential to the nation's welfare. In any vast project there are bound to be some abuses.

Conservation and reclamation projects are being built in the East and the South as well as in the far West. Mt. Morris dam, for instance, in central New York will save thousands of acres of fine land from damage due to floods. Probably 20 million dollars, the cost of this one project, is a lot of money but, in terms of loss in Rochester alone when a single flood buried the business and residential sections under eight feet of water the figure is not large. In the South, two big dams are under construction: Bugg's Island (Va.) and Clark Hill (Ga.). Alatoona dam in Georgia is practically finished; another is just getting under way in the north Florida area. These are intended to be self-liquidating projects when viewed from a dollar and cents angle.

There are some big projects moving ahead in the prairie states and in the Colorado and Columbia river basins, and some of them rank with the Panama Canal when considering cubic yards of material handled. Just re-



Left: General view of all-steel plant operated by Bethlehem Steel Co. Right: In the quarry, a large amount of rock overburden was being stripped. Limestone below is said to be especially suitable for use by the steel industry.



cently the largest deep frame jaw crusher in the world was shipped from the East to one of these western projects which, incidentally, is a comparatively small construction job.

Distance always seems to add enchantment to the mediocre. One eastern producer with whom we talked could not see much to be found in the eastern areas that would be of general interest to the rock products industry. A few weeks later we ran into the use of "Jet Piercing" at a New Jersey quarry and to this traveler it was the most spectacular event of the year. Jet piercing is a method of drilling whereby a glorified oxygen-acetylene flame is used to burn and to spall holes for primary blasting. In place of acetylene, however, coal oil was being used. We published, in our November, 1949, issue, a detailed article on this development. After seeing this highly interesting technique, if someone had told the writer that flying saucers were being used in a neighboring state to transport sand and gravel or that atomic energy was being used for blasting, we would have gone and taken a quick look without feeling that someone possibly was doing a little ribbing.

We have seen operators of large plants supplying their workmen with safety glasses, the lenses of which were precision ground, each workman having been previously taken to an optometrist to have his eyes tested or corrections made in the lenses for his own privately used safety goggles. This operator found that good vision was just as essential to good work as was protection of the eye from flying particles.

New developments in transportation keep coming to our attention. According to reports, sugar growers in Hawaii, who are now using rail transportation with the rail mileage involving some 250 miles of road bed, are planning to replace this railroad with paved roads that will have sufficient wheel carrying capacity for them to use rubber-mounted haulage units that will carry a pay load of 96 tons per vehicle. Truck loads in the rock products industries are now as high as 40 tons (used only on privately owned roads) and last year we reported one producer who planned on a 60-ton pay load. Here the sugar producers may be pioneering a field for rock products producers.

#### Concrete Block Developments

In the East we found a concrete block manufacturer manufacturing a lead-lined concrete block. The lead lining was intended to head off harmful radiations from atomic particles. Another was making a concrete block with a marble face available in any desired color. The patented process consisted of making a face material of concrete (white portland cement, white marble aggregate, plus color-



Roadside parks with picnic facilities, consisting of shelters, fireplaces, benches and tables, can be found along many of Florida's highways. They are neat concrete block units, as shown here. Refuse pits also are of block construction

ing matter) and vibrating these materials in a shallow stainless steel pan. This pan with its green concrete was then placed in the front section of a tamper mold box and ordinary concrete tamped in behind it. After steam curing, the stainless steel face was removed and a block came forth that was marble-like in texture and a truly beautiful piece of concrete merchandise.

At a southern concrete products plant we saw samples (made elsewhere) of another type of colored concrete block. This block had as its colored face a thin steel plate to which had been glazed an enamel face. This, too, was available in most any color. The face of the block looked like the porcelain on a bath tub, or colored tile in a bathroom. The manufacturing process consisted of placing this metal plate with its glazed face in a tamper mold box. A magnet pulled the assembly (and held it firm) to the front of the mold box after which the concrete was tamped into place. Metal lugs on the back of the steel plate buried themselves in the green concrete and held the porcelain section onto the concrete block. It was a remarkable and artistic addition to the concrete block industry.

Still a third idea was spraying, in a continuous manner, on cinder block with a plastic facing material. After first heating the block with infrared heaters, the hot plastic, dissolved in a solvent, was sprayed on the block. The plastic was baked to the block in a continuous furnace. Later the units were shipped in cardboard containers. The color range was wide. There were continuous, relatively low cost, high capacity units and a development pointing the way to better homes in the future.

The big need, and the big market for concrete products, is in the home

construction field, and there appeared to be a need to make more and more designs or plans available to the home builder and into which precast structural units are incorporated. One and two and even three storied designs are being asked for and the designs must be "slanted" toward the general type of architecture in a given section. Spanish architecture may be all right in California and Florida. People in Philadelphia on the other hand seem to prefer two-story homes, and requirements vary again in other areas.

Bridge girders of precast concrete using steel wire rope as reinforcement are being tried with success in the East. Long span floor joists, precast floor and wall panels, precast bridge beams and bridge decks, precast concrete structural beams (to replace steel) for office structures, precast panel construction systems, colored floor tile, hollow ceiling, floor and wall tile that act also as heating ducts, precast telephone booths, precast concrete laundries and many other developments too numerous to mention are some of the interesting things to be found in the East and in the South.

We have seen many of the new Quarrymaster drills in operation in using both tungsten carbide bits and conventional steel bits. One of the late wrinkles in drilling technique is the use of rotary drills similar to those used for oil well drilling and a still later variation of this principle is the use of rotary drills supplied air instead of water to keep the bit cool and to remove cuttings. This latter unit is said to be much faster than the water-cooled machine on some types of rock.

Early in the past year we thought it might be a good idea to collect data on the use of tungsten carbide bits for smaller drills, including wagon drills, but so many companies had



Another large project being completed under supervision of the U. S. Army Engineers is Buggs Island dam in Virginia

branched out on their own and were using this type of bit that we held the project up because we felt their use was already so widespread that there was little news value. One operator in the South, however, was using carbide bits wet on wagon drills. Most of the other operators were using the bits dry.

#### Lightweight Aggregates

There is a widespread interest in the manufacture of artificial lightweight aggregates. Several of the larger trap rock companies have been quietly doing some experimental work in efforts to develop a high grade aggregate of this type. Perlite is another aggregate that is commanding attention throughout the eastern sections of the country, particularly for plaster, and several plants, using raw materials shipped from the West, are going into production with expanding plants or have just recently started. One big coal company recently started a large lightweight processing plant in eastern Pennsylvania, using as raw material culm from its coal mines. The finished material apparently is of high quality. Several large concrete products plants are studying the feasibility of a lightweight aggregate plant as a part of their operations. We also heard rumors that pumice would be shipped into the United States from sources in the Caribbean Islands. Others have expressed the view that pumice is the best cheap material found so far to ward off harmful atomic radiations and, when Congress wakes up to this fact, according to one source of information, the construction industry would experience a revolution.

We have found no indications of industries dispersing as protection from possible future atomic wars, and while

the press screams about cobalt as a replacement for uranium, and of hydrogen atomic bombs far more powerful than any before developed, all industry goes blithely on its way, crowding closer and closer together, rather than spreading out.

The heavy media separation process which we have followed with interest, as it pointed the way to better processing of some coarse aggregates, was adopted by a Canadian contractor to treat poor quality gravel for airport runway construction with excellent results. A heavy media plant went into the barite field in Georgia and is successfully treating rejects from older operations. Another plant went into the fluorspar fields in the Illinois-Kentucky production area. In our travels we have seen many plants in the industry where the heavy media process could well have application.

Manufacture of sand has assumed a commanding position in the rock products industries, particularly where the sand must be prepared from the same ledge rock materials as the coarse aggregate. A new sand manufacturing plant went into operation in the East using an impact-type of pulverizer as the preliminary breaker, and a rod mill for the final grinding unit. The raw material was a semi-consolidated sandstone. Two conical ball mills for pulverizing silica sand went into a New Jersey plant, and we described in our October, 1949, issue how a conical ball mill was used for processing sand at Dorena dam in Oregon.

Projected new portland cement plants have not been confined to private capital. In North Carolina, during this past Spring, serious consideration was being given to the construction of a state-owned portland cement plant. Happily, this venture

met with considerable local opposition and the bill up for consideration has been bottled up for the time being. A similar project was said to be under discussion for Alaska. One large producer of ready-mixed concrete was considering building his own portland cement plant as he was using four to five carloads of cement per day and had raw materials available.

#### Portable Plants

Portable plants for processing sand and gravel and crushed stone are becoming an adjunct to some established producers with stationary plants. Due to high freight rates, these producers believe it necessary to take their plants to the job. We have noted many instances where, if this was not done, the contractor purchases his own portable plant and, in many instances, when the job was completed the contractor stayed in the rock business as a commercial producer, thus changing the local competitive picture. The state of Maine is operating a state-owned portable aggregate plant. This development, along with several other portable plants in the area, was discussed in our December, 1949, issue.

It is noteworthy that most of the new plants built in the rock products field have been of steel construction using reinforced concrete for the foundations, whereas it used to be the general practice to build a rock plant of wood construction. It is surprising how soon a wood plant gets that saggy look while rock plants of steel construction built 20 to 30 years ago often look like new. With so many plants of steel construction, particularly on the seacoasts, where the salt air seems to be an active promoter of rust, control of rust is a subject worthy of general study. Better types of steel, and better protective coatings, are developing and we are quite impressed with recent processing patents and methods whereby rust inhibitors, soluble in the lubricating oils, are on the immediate agenda. This should be of particular interest to the operator of air compressors, for it has been very definitely established that the main cause of air receiver explosions is due to rust in the receiver and, it is said in this regard, that rust acts as a catalytic agent and that heat from it ignites the explosive vapors. We have not heard of any bad air receiver explosion during the past year, where anyone was killed at least, so it might be a good thought to look into the subject before someone does get hurt.

Mass vacations for employees are being practiced by many in the rock products industry and its practicability is being studied by others.

One large cement plant, a large sand producer, and several others, put their production and office facilities

(Continued on page 144)

## STOCKPILING and RECLAIMING STONE

**Kingston Trap Rock Co. designs an entire plant around stockpiling system with reclaiming tunnel to accommodate standard railroad cars**

By WALTER B. LENHART

PROGRESS in the crushed stone industry is a process that usually involves a few individuals, or a company, that have the vision and the courage to do something in a different way, and we feel, without qualification, that the work that has been going on at the Kingston Trap Rock Co.'s plant and quarry near Kingston, N. J., will, in the years to come, be considered as pioneering.

The program that has been going ahead at Kingston under the direction of L. R. Gilbert, president of Kingston Trap Rock Co., has been broad and diversified. We covered one part of it in the November, 1949, issue of Rock

Products wherein we described in detail the use of jet-piercing as a primary drilling technique in the quarry. The company loaned its facilities and quarry to the engineering staff of the Linde Air Products Co. and, during the past year, a considerable number of holes were drilled in the diabase trap rock using this method. Jet piercing is the name given to the method of drilling in quarry work using an oxygen-kerosene flame in conjunction with water sprays to drill the holes for primary shots. This type of drilling is not only intensely spectacular and therefore of great interest, but it appears to have economic aspects of great interest to the rock producer whose drilling costs are high. We have a feeling that from the pioneering work done at Kingston, jet piercing will find a place for itself in the crushed stone industry.

Having tackled, with a new approach, the important process of primary drilling—one of the first steps in any quarry operation—the officers of the company took up the subject of reclaiming from stockpiles—which is one of the last steps in a quarry operation—and during the year built an entirely new plant that was, in part, designed around a new and novel system of loading cars or trucks or reclaiming for the plant. The stockpiling and reclaiming system is equally as spectacular and interesting as was the drilling development. Essentially, as will be seen from the photographs, the reclaiming tunnel is of such large dimensions that it accommodates a broad gauge railroad track from which standard gondolas can be loaded direct, as well

as two lanes for truck loading. At the same time, the large concrete tunnel will have a 30-in. reclaiming belt running its entire length. This belt is suspended from the ceiling along with a suitable cat-walk and it can be used to return any desired size of stone to the plant.

The rock processed here is an extremely hard and tough trap rock (diabase) of such excellence that it is shipped over a wide area in the East and is very favorably known in the districts that the company serves. In designing the new plant, to go along with all the other developments, a 48-in. Traylor gyratory crusher was chosen as the primary unit. It operates in conjunction with a 7-ft. Symons cone crusher and two 4-ft. Symons short-head crushers. We mention these facts here because it is necessary to know why certain features were incorporated in the design of the new plant and the stockpiling tunnel. After crushing in closed circuit with two Robins screens that follow the secondary and final reduction crushers, the material is split into a coarse fraction and a finer fraction. Each portion goes to an elevated steel structure housing two 6 x 12-ft. 3-decked Robins vibrating screens. After screening, the sized rock is elevated still further via stockpiling belts that finger out over the reclaiming tunnel. The maximum fall of the rock to the storage area is in the 80-ft. range but due to the hard and tough nature of the rock little, if any, degradation takes place because of the high fall. Here is one stone that requires no stone ladder to lessen breakage when rock falls into its stockpile.



Coyote hole slopes downward about 6 ft. in 50 ft. so a small hoist is being installed to remove muck



Rock grab in quarry of Kingston Trap Rock Co.

## STOCKPILING

The rim of the quarry forms a large semi-circle which is almost "U"-shaped. The new plant and stockpiling facilities are located on the worked out portion of the quarry floor and about midway between the legs of the "U"-shaped quarry. The worked out part of the quarry is of such large area that blasting does not interfere with operations of the new plant even though the Kingston Trap Rock Co. has, in the past, depended on the coyote or tunnel blasting system for most of its rock. On Nov. 3, 1949, at the time of our inspection of the plant, a coyote tunnel shot was fired. This shot was loaded under the supervision of duPont engineers and even though the shot was located on that side of the quarry nearest the new concrete stockpile tunnel, the shot was eminently successful and this is even the more remarkable, for at the time of the shot, no crushed rock was on top of the concrete tunnel that otherwise would have acted as a protective blanket. Churn drilling in this type of rock is at the rate of 1 to 2 ft. per hr. The face of the quarry averages about 80 ft. in height.

The concrete tunnel making up the reclaiming system consists of two sections with a road or passageway about midway of the sections. Each is 43 ft. wide and 19½ ft. high. One leg is 376 ft. long and the other is 360 ft. About 8 cu. yd. of concrete per ft. of length were used in the construction of the tunnel and roughly 100 tons of reinforcing steel were used. Atlas speed forms were used. The drawing shows the essentials of the method used in constructing the tunnel which included the use of a standard gauge flat car mounted on standard gauge rails. By suitable jackscrews, posts and wedges, the forms were held in place until the concrete had set sufficiently for the flat car unit to be moved ahead for the next section. The tunnel was poured in sections of the arc. The company designed and built the reclaiming structure with the concrete coming from the company's own ready-mixed concrete plant that is located adjacent to the quarry.

Before putting any crushed stone over the tunnels, a considerable amount of fill was placed along the outside base lines so as to increase the amount of live storage as compared to the total storage capacity. For this work stripplings were pushed over the rim of the quarry and this material was used in conjunction with some crushed rock from the primary crusher. A fleet of Mack trucks augmented by a LeTourneau Carryall handled the material for the fill. The total capacity of the storage pile is given at 150,000 tons of material.

Three parallel lines of outlet gates are located in the tunnel. Under the fine rock section there is a total of 47 duplex clam-shell gates and 47 are located in the tunnel under the coarse crushed rock section. Twelve to fifteen standard gauge cars can be



Primary gyratory crusher is in pit in center of quarry floor



Looking down on surge-pile conveyor on quarry floor



Electric shovel loading side-dump truck



Retouched view of stockpiles over large reclaiming tunnel. Midport of tunnel may be seen, center

loaded per hour and the company uses a Whitcomb locomotive for switching and spotting purposes. Robins conveyors are used in the tunnel reclaiming system.

Due mainly to the character of the rock produced from the quarry, production of riprap plays a large part in the operation. The cross faults in the face of the quarry, along with the system of blasting used, produce riprap up to 10 to 15 tons in size, and at the same time, produces enough finer stone to keep the new 800 t.p.h. plant running. Most of the riprap is loaded to Mack trucks by an Owens "rock grab" that operates from a Northwest crane. The rock grab will handle stone up to 10 tons and, for the larger pieces, chain slings are used with the 4-cu. yd. Marion 4160 electric shovel that also does a large portion of the primary loading. Another 4-cu. yd. shovel will be added in 1950. The company has a second 2-cu.



Surge pile that receives primary crusher discharge

yd. Marion 480 that is also used for loading in the quarry along with the 4160. For the new crushed stone plant, a fleet of Easton T-R side-dumpers mounted on Mack trucks does a considerable part of the haulage.

To assist in the tunnel shots the company has several churn drills as well as Ingersoll-Rand wagon drills. Air for these and the smaller drill is supplied by a Sullivan and a Le Roi portable compressor, both rubber-mounted. A Link-Belt crane finds use about the primary crushing section.

The new plant went into operation about mid-November of 1949 and the company expects to hold an official opening sometime this coming Spring at which time highway officials, engineers, contractors, and others interested in trap rock will be the guests of the company.

All elevating and conveying in the plant is accomplished by belt conveyors. The new section operates dry. The layout involves the use of some 16 separate conveyors that are all driven by individual electric motors through suitable speed reduction units.

The 48-in. Traylor gyratory pri-

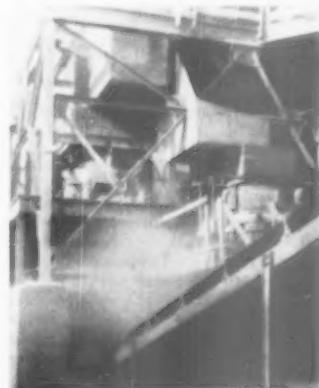
mary crusher is set in a concrete lined pit in the quarry floor at such an elevation that the Easton side-dumpers can dump direct to the crusher. Any rear-dump trucks that might be used as auxiliaries also dump direct to the Traylor gyratory. Three new Easton TR-13, pan-type side dump semi-trailers are in service to supplement the older rear-dump bodies. The average haul is about 1700 ft. The new semi-trailers haul an estimated pay load of 18 tons and each make approximately 60 trips per 9½ hr.

The rock, crushed to about 8-in. size, falls to a 42-in. Goodrich belt that elevates and delivers to a steel transfer station, the primary purpose of which is to deliver the rock to another 42-in. cross conveyor serving the primary surge pile. However, if desired, crushed rock can by-pass this second belt and load direct to trucks from this elevated steel structure.

Reclaiming from the surge pile following the primary crusher is via a 50-M Syntron electric vibrating feeder that delivers the rock to a



Electric vibrator feeder-grizzly that puts fine rock on belt ahead of coarse for added cushioning effect. Note disc carrier rolls under point of impact



To left is 7-ft. cone crusher and to right is 4-ft. short head crusher

36-in. conveyor belt serving the 5- x 12-ft. Robins 3-deck dry, Gyrex scalping screen. At time of inspection, only the top and bottom decks were being used. This Syntron feeder in the tunnel under the surge pile is provided with a short grizzly at a point ahead of the belt conveyor so that fine material falls to the belt first and then serves to protect the belt from the larger rock. Additional protection to the belt is provided by the Continental impact idlers that are installed immediately under the belt at the point of leading. The Continental disc idlers are of rubber, and, as their name implies, are made up of a series of rubber discs. They are mounted on Timkin bearings. The use of this type of idler under the loading point is to protect the covering of the belt from damage which in turn helps prevent breakdown of the main carcass of the belt. Similar rubber disc idlers are used under one of the belts at the "circuit tower" that will be described later. The belt from the surge pile is driven through a Jones herringbone speed reducer, augmented by roller chains, by a Crocker Wheeler-Joshua Hendy induction motor.

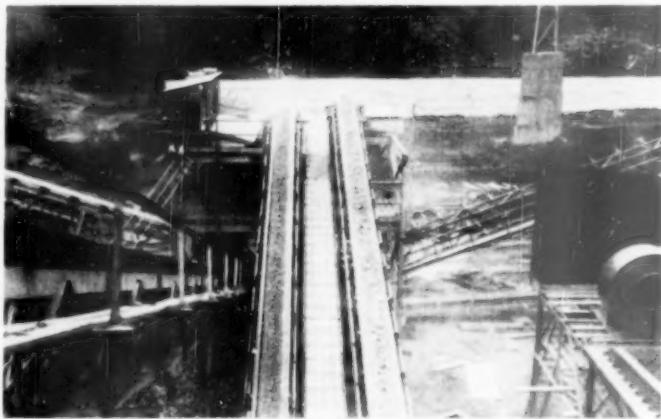
The Robins scalper screen has a 3-in. square opening for the top deck and  $\frac{1}{2}$  in. for the bottom deck. Oversize from the top deck falls to the 7-ft. Symons cone crusher that is set to deliver a 2 $\frac{1}{2}$ -in. product. The 7-ft. cone crusher delivers to an inclined belt that serves a dry, 3-deck, 5- x 12-ft. Robins vibrating screen that is located in what is referred to as the "circuit tower." The oversize (minus 3 in. plus  $\frac{1}{2}$  in.) from the lower deck of the scalper falls to one of the two 40-ft. Symons short-head crushers and the products from these crushers are elevated to another Robins screen located in the circuit tower. The plus 2 $\frac{1}{2}$ -in. material from either vibrating screen is returned to the short-heads by a common inclined belt conveyor.

The circuit tower is a steel structure which, as its primary purpose, splits the crushed stone into two main fractions—fine and coarse—and returns any unwanted oversize back to the cones. There is no crushing done after the rock has once passed this circuit tower. The split here is on the  $\frac{1}{2}$ -in. screen and the plus goes to a long inclined belt to two final 3-deck, dry 5- x 12-ft. Robins screens mounted in a high steel structure. Three of the sized products from these screens fall to separate piles over the concrete reclaiming tunnel. These sizes are: plus  $\frac{1}{2}$  in. minus 1 in., plus 1 in. minus 1 $\frac{1}{2}$  in., and plus 1 $\frac{1}{2}$  in. minus 2 $\frac{1}{2}$  in. Any plus 2 $\frac{1}{2}$ -in. stone that might have slipped through the previously described closed circuit falls to the ground under the steel structure housing the vibrating screen and not on the reclaiming tunnel. The belt serving this fourth Robins screen (Belt No. 15) is a 36-in. unit. It is the one that is also provided with the

(Continued on page 140)



Primary crusher discharge goes to this transfer station that serves belt conveyor to surge pile or loads trucks. Large rock at base of structure protects belt from flying rock at time of blasts, since belt operates on quarry floor



Two parallel belts that return oversize to secondary crushers. Fan, extreme right, is part of dust collection system being installed



Rock from primary surge pile being delivered to scalping screen

# Durability

## Have the Real Fundamentals Been Developed for Making Good Concrete?\*

THE QUESTION naturally arises, that since it is undoubtedly the kind and character of the porosity in hardened cement, mortar and concrete, which determine its lasting properties, what kind of porosity and other allied physical properties should we aim for? The best answer we can find to that is attributed to René Feret, the famous French cement and concrete specialist of the last century, who was careful to distinguish as follows between porosity and permeability. Porosity he defined as the total space occupied by liquids and gases. The narrower and more abundant is this space, the greater the capillary or adsorption and the greater the penetration of salt solutions into the interior. Permeability he defined as the amount of liquid or gas which will flow through a given cross-section in a given time under a unit pressure differential.

Keeping those distinctions in mind, Feret who was an expert on concrete in sea water said: "The cement to use may well be chosen for a minimum tendency toward disintegration. [This evidently means the disintegration of the cement particles themselves, which we have described as caused by the "exploding" lime while hydrating.] Sufficient cement should be present so that, when exposed to aggressive solutions, the bulk of the pores should have become obstructed by the insoluble compounds formed by the previous action of water on the cement and resulting from carbonation of a large part of the lime set free. Such lime has been gradually brought to the surface as the concrete dries out, and forms there, on carbonation, a protective crust which reduces the movement of aggressive solutions through the concrete."

Elsewhere (*Proceedings of the Institution of Civil Engineers, 1892*) Feret describes experiments with mortar in sea water. He reported: "These experiments exhibited clearly the difference between the permeability of the mortars or their capacity for allowing water to pass through them, and their porosity or their power of retaining water in their pores. Generally, the most porous mortars were the least permeable, and vice-versa. Coarse sands produced mortars which, having few but comparatively large interstices, allowed water to percolate freely through them. Mortars on the contrary made of fine sands contained numerous small pores into which the water penetrated, but was retained by

By NATHAN C. ROCKWOOD

capillary attraction, and, consequently, while exposing a much greater wetted surface than mortars made with coarse sands, allowed little water to pass through them.

"The results of passing sea water through permeable, and through porous mortars were very different. With the former (permeable), an abundant white efflorescence was quickly deposited, due to the decomposition of the calcium silicate of the cement into a product less rich in lime, and into lime which carried along by the water was converted into carbonate by contact with the air, or with the sea water, which was always more or less charged with carbonic acid. No alarm need be felt at the appearance of the efflorescence for the mortars on which it was found could resist the decomposing action of sea water for numbers of years, and moreover their permeability rapidly decreased. In porous mortars, the efflorescence was much less abundant, and never attained any great thickness. After periods, however, of varying duration, depending on the quality of the cement and the manufacture of the mortar, thin white hair cracks appeared on the surface, which very soon enlarged, changing into fissures which opened more and more till pieces fell off and laid bare a soft pulp of decomposed mortar inside the block."

It is believed that the disintegration of concrete generally is similar to its disintegration in sea water. In freezing and thawing it is ice crystals instead of magnesium sulphate crystals that expand and cause cracking. Or it may be the release of some min-

eral component in the concrete matrix, such as the alumina-sulphates, which crystallizing with an excessive amount of water causes expansion. But, in all cases, as Feret pointed out, it is primarily the character of the porosity of the mortar or concrete which is the cause of disintegration. There is nothing new or startling in such a conclusion because geologists know that the same kind of porosity in rocks of every kind similarly affect their weather-resisting properties.

This is entirely a physical characteristic and is unrelated to chemical or mineralogical composition except in so far as this may affect the porosity. Take for example the famous experiments on disintegration of concrete in alkali waters, which led directly to our present specifications for sulphate-resisting portland cements. In the majority of cases of failure the cements contained more than 4 or 5 percent of tricalcium aluminate. But there were at least two or three which contained considerably higher percentages, and yet were as good as the ones low in alumina. That certainly is proof that the alumina compounds, per se, were not the cause of disintegration. Unfortunately these cements were not studied as to whether or not they made porous mortars or concretes. It is conceivable that these two or three exceptions to the general rule were so well graded in particle size distribution that they made a compact nonporous mortar. The reason why the usual cements high in alumina compounds are generally less durable in alkali waters, is evidently because the alumina gel itself takes up more water than silica or iron oxide gel, and consequently is more porous. You can go back through a great accumulation of literature on concrete experiments, and find a variety of reasons for concrete failures in specific instances, but you never find a real study of the part the porosity of the material may have had. We seem always to have sought for reasons in the chemical composition of the cement, aggregates or concrete, when the real answer probably was in the physical character of the conglomerate as a whole.

A random example of this is the report of H. S. Mattimore and G. A. Rahn, *Proceedings of A.S.T.M.*, 1935, on the result of 4½ years exposure of 45 experimental headwalls. Two ce-

\*This is the concluding part of the paper delivered to the Materials Engineers' Division of the Southeastern Association of State Highway Officials at Little Rock, Ark., December 1, 1949. The first part of this paper was published in the December, 1949, issue of Rock Products, page 110.

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ments and two sands were used. The two cements A and B were described as follows:

Cement A had 8.8 percent retained on No. 200 sieve

Cement B had 15.5 percent retained on No. 200 sieve

Cement A had 1.0 percent alkalies

Cement B had 0.61 percent alkalies

Sand C had 95 percent passing No. 4 sieve

Sand D had 99 percent passing No. 4 sieve

Sand C had 53 percent passing No. 20 sieve

Sand D had 66 percent passing No. 20 sieve

Sand C lost 17.3 percent in the sodium sulphate test

Sand D lost 5.2 percent in the sodium sulphate test.

The average present-day reader would probably say that Cement A being finer ground was the better of the two; that Sand C was obviously bad, although apparently it was better graded.

The test specimens were rated according to the percentage of intact concrete remaining after the exposure.

The specimens made with Cement A had lower ratings with both sands.

The specimens made with Cement B had higher ratings with both sands, and with little difference between the two sands.

From the photographs of the disintegrated concrete, with our present knowledge of alkali reactive aggregates, we would be tempted to conclude that Cement A with 1 percent alkali content was the cause of its poorer performance.

But was it? We learn that the good cement B was not only appreciably coarser ground, but that it contained 3 percent less tricalcium silicate and 4 percent more dicalcium silicate, than Cement A, and yet Cement B had 3 percent more magnesium oxide than Cement A! The other calculated compounds appeared to be about the same.

The authors concluded merely that Cement A and Sand C were bad actors. The only logical conclusion that seems possible is that Cement B was so superior to Cement A because of its coarser grinding and smaller content of tricalcium silicate that it overcame the handicaps of both poor Sand C and the extra content of 3 percent of magnesium oxide.

There are, so far as I can find, no studies of the porosity of hardened neat cement, mortar and concrete, such as have been made of some building stones as for example marbles. For instance, there is Technical Publication No. 1261 of the American Institute of Mining and Metallurgical Engineers, "Geological, Chemical and Physical Problems in the Marble Industry," by George W. Bain. Here it is stated: "Salt solutions do not affect equally even marbles that are similar in appearance. Stones with openings less than 2.5 millionths of a centimeter [0.025  $\mu$ ] wide yield to so-

lution slowly and those with openings about 3.5 millionths of a centimeter [0.035  $\mu$ ] wide dissolve most rapidly. Solution diminishes where openings exceed 6.0 millionths of a centimeter [0.06  $\mu$ ] but frost begins to cause disintegration. The solutions become less effective as they widen the openings and the rate of weathering decreases."

There are, of course, other factors, such as crystal arrangement, in marbles which affect their durability. The point is that even with a homogeneous material like marble, the size of the pores is probably the most important factor in durability. Another study, that concrete researchers could well imitate is "The Nature and Origin of Limestone Porosity," Vol. 43, No. 4, *Quarterly of the Colorado School of Mines*, by Richard B. Hohlt (1948). This study has nothing to do with concrete or concrete aggregates. It was made by a petroleum geologist to explain why petroleum is seldom found in high calcium limestone deposits but most often in dolomite. It is a discussion of pore origin and pore size. Briefly, it seems that the pores in unaltered high calcium limestone are too small to adsorb or contain oil, while the pores in dolomite are much larger. Thus we have a physical reason why dolomite is almost invariably a more durable rock than a fine grained high calcium limestone. There is a great deal of helpful material in the literature of geology, that long ago should have pointed the way to research on those physical properties of cement, aggregates and concrete which are intimately associated with their porosity, and therefore with other colloidal aspects of the problem.

Recently, the Indiana Joint Highway Research Project, under Prof. K. B. Woods, has investigated the effects of size and volume of pores in cherts and cherty aggregates, high calcium limestones and siliceous river gravels to determine the durability of concrete made with them. The percentage of "absorption," which has been a test for aggregates for many years, according to these Indiana experiments, "does not appear to present a sufficiently accurate index." Other investigators have come to the same conclusion. Wuerpel and Rexford, in their paper "The Soundness of Chert as Measured by Bulk Specific Gravity and Absorption," A.S.T.M. *Proceedings*, 1940, state that while there was usually a close relationship between bulk specific gravity, pore structure and durability, they also noted that some cherts of high bulk specific gravity were nondurable and apparently had innumerable submicroscopic pores. Bulkley, in a U. S. Bureau of Standards Research Paper, 1931, on "Viscous Flow and Surface Films," shows that liquids may be expected to flow through capillaries far smaller than can be distinguished by the microscope. Rhoades and Mielenz in their paper "Petrographic and Mineralogic Characteristics of Ag-

gregates," A.S.T.M. *Proceedings*, 1948, state: "Pores less than 4 $\mu$  (0.004 mm.) in diameter control the durability of solid particles subjected to progressive freezing. In a broad sense internal pore characteristics of the particles are the most important properties of aggregate materials."

The same authors in the *Journal of the American Concrete Institute*, June, 1946, state: "Water moving by capillary will not enter aggregate containing only large voids, even if these voids are interconnected and penetrable. On the other hand, small voids will be penetrated; and if these openings are smaller than those in the cement paste, the water will preferentially be drawn into them from the paste. During periods of hydration or drying, while water is being withdrawn from the interstices of the cement paste, water will be drawn by capillary from aggregate particles containing only voids which are larger than those in the paste; but the last residuals of water remaining even in relatively dry concrete may be concentrated in aggregate voids smaller than those in the cement paste."

H. S. Sweet, of the Indiana Joint Research Project, in a paper "Research on Concrete Durability as Affected by Coarse Aggregates," A.S.T.M., 1948 *Proceedings*, said: "It may be possible to develop procedures by which aggregates having the characteristics reported [that is high absorption and numerous fine pores] can be used with safety" . . . as explained further if these aggregates are permitted to dry out either before or after they are incorporated in the concrete; and one way to permit the concrete to dry out is to provide a granular or drainable base under it—or in other words, don't allow the concrete and the aggregates to remain saturated. Sweet says: "The volume of pores smaller than 0.005 mm. (5  $\mu$ ) diameter appears to be a critical index of field durability of Indiana aggregates, probably because of the influence of pore size on water retention and capillary characteristics of the rock material. Materials having a volume of voids smaller than 0.005 mm. diameter size of less than 0.06 per unit of solid volume [that is 6 percent] had good service records in concrete pavements, while those having a value of this criterion of 0.10 [10 percent] or greater had demonstrated unsatisfactory performance in pavements."

If we will consider that hardened portland cement paste is essentially silica and/or alumina gel, precipitated and hardened in the interior of the concrete, and that it has essentially the same as or greater porosity than chert, which is also an aged silica gel, we can better understand the important part the cement itself may play in concrete pavement disintegration, not because of any chemical characteristics of the cement or aggregate combinations, per se, but be-

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cause it has the same objectionable small-pore characteristics as chert and some other rocks. Therefore if we want to know why concrete fails, we should examine concrete for the kind and quantity of the porosity it makes as a hardened conglomerate. The reason why some old concrete is still sound evidently is because in hardening and curing the formation of more than 10 percent of the volume in these submicroscopic pores was avoided, accidentally perhaps in some instances, but by design in others. With available knowledge of colloid chemistry, it need not again be accidental.

There is a tremendous amount of proof in the literature that the durability of concrete is a function of its pore characteristics, although such data are more or less buried in floods of words about far less important characteristics of the cement or concrete. For example, Cesare Zamboni, an Italian expert on concrete, in the Italian journal, *Il Cemento Amato, Le Industrie del Cemento*, Vol. 33, No. 9 (1936) said: "Determination of the porosity of the cement-puzzolan mixture is the most convenient and best way of evaluating the effectiveness of a puzzolan admixture. A study of ancient Roman concrete shows that porosity is the most important factor in the durability of the concrete." F. H. Jackson, Bureau of Public Roads, in his paper "The Durability of Concrete in Service," *Journal of the American Concrete Institute*, October, 1946, describing the failure of some of the concrete in highway structures constructed after 1930, said this concrete contained many "D lines," had little strength, with a matrix of "a dull, chalky appearance in sharp contrast to the dense, compact, bluish-gray matrix usually found in good concrete." Speaking of some of the good old concrete structures he said: "The matrix is dense and crystalline. \*\*\* We find concrete of this character on many of the older pavements and bridges."

### Crystalline Not Amorphous Matrix

In these few words lies the secret of good concrete and the reason for failure of some more recent concrete. The matrix of the concrete that failed was described as "chalky"—the favorite way of describing a material that is "amorphous" or fine grained and very porous. The good concrete whether it is 2000 years old like the Roman or 30 years old as in some of the far West highway structures, is predominately "crystalline." Why then is much of the matrix of modern cement-mortars amorphous and of the old cement-mortars crystalline? As we have seen, there could be two reasons: (1) the original concrete had coarse pores and was in the beginning permeable, so that the lime dissolved out and was crystallized as carbonate on the surfaces and in the

pores and capillary channels; (2) there was little or no fine porosity of the detrimental kind from the beginning.

The first condition could result from the use of relatively coarse cement and coarse sand. Feret showed that, and he recommended leaving out sand sizes finer than 0.5 mm. (500  $\mu$ ), or something like a No. 10 or 12 mesh standard U. S. sieve size. For best results he would add a finer ground puzzolan. The lime and the puzzolan would then eventually fill the coarser pores with stable silicate and render the concrete not only nonporous but more nearly impermeable. The second condition could be accomplished by the use of a cement which in hydrating did not yield such an abundance of amorphous material (that is chiefly gel) as do our present portland cements. Such cements might be more coarsely ground, but in any event they would be less reactive than present high tricalcium silicate and high tricalcium aluminate cements.

Being guided during the last 25 or 30 years almost solely by demand for high compressive strengths in the shortest possible time, we have not only discarded the tests for tensile strength of neat cement, but we have overlooked the significance of this test in disclosing the amount and character of mineral glue or gel, which is the real key to successful concrete. We have proceeded on the theory that the more gel and the faster it formed, the better the cement. Now, maybe we are just beginning to realize that the less gel and the slower it forms the fewer will be our troubles, from both heat of hydration, and from subsequent volume change. For, while the gelatinous precipitate, which is the hardened cement paste, is not reversible to a gel, it does retain many of the properties of a highly adsorptive medium, and can cause trouble either by adsorption of water, or of colloid minerals in the water and by abnormal shrinkage or expansion. The Army Engineers want to make two-bag per cubic yard concrete, and there is merit in their proposal from the angle of reducing the amount of gel. The thinner the film of "glue" between aggregate particles the greater their adhesion to one another and the stronger the concrete, and the less volume change.

One of the virtues claimed for a high tricalcium silicate content of cement is that in hydrating it makes a great deal of gel (silica gel we will call it) rapidly. The objection made to high content of dicalcium silicate is that it is relatively inactive and hydrates so slowly not much gel is formed. Here we run into some very important facts reported by L. S. Brown and R. W. Carlson, in their paper: "Petrographic Studies of Hydrated Cements," *A.S.T.M. Proceedings*, 1936. The specimen of pure tricalcium silicate was completely hydrated and at-

tained a compressive strength of 10,000 p.s.i. some 60 percent of which was reached in 7 days. The pure dicalcium silicate on the other hand was not more than 25 percent hydrated at the end of a year, but it also had attained a compressive strength of 10,000 p.s.i. This evidently is proof that, unless immediate high strengths are required and the concrete is to be kept dry, desired strengths can be had more safely with a small quantity of gel obtained from hydration of the dicalcium silicate, than with a larger quantity from the hydration of tricalcium silicate. The addition of an active puzzolan increased the amount of gel in either case. The calcium hydroxide in the pores and capillaries of the gel was not apparently in crystalline form, but when exuded by the gel in the process of shrinking or syneresis, it did, or at least could, form crystals outside the gel.

The crystalline form of calcium hydroxide is preferable to the amorphous form because, having less surface area, it is less reactive. But, one never finds calcium hydroxide crystals in old concrete. The lime has either been converted to carbonate, or it has dissolved out, or it is combined with other minerals in a more insoluble form, such as the aluminates, calcium-aluminum-silicates, etc. The crystalline form of any of the mineral end products of cement hydration is preferable to the amorphous form, for the same reason. Moreover, in crystals of hydrous minerals the water is assumed to be in molecular combination, or is "fixed," and not subject to migration and freezing as when it is merely adsorbed in a porous gel or solid.

### How to Promote Crystallization

Since good old concrete from whatever source derived is crystalline and some more recent bad concrete is amorphous or porous, the problem is why? And how can we go, crystalline end products? From a study of cement and concrete literature and collateral reading of textbooks on colloid chemistry, the logical answer seems fairly clear. First we want to avoid a cement that as Feret said would disintegrate too readily. That would be a cement which did not contain high percentages of either tricalcium silicate or tricalcium aluminate, although it might be a coarsely ground cement of this character. Judging by some of the good old cement analyses, they could be high in alumina, if the alumina was combined with lower ratios of lime. Second, we want a fairly coarsely ground cement, or we want some other pulverized mineral ground with it, which will supply some of relatively coarse fractions that are missing in finely pulverized cements. Third, we want as near as possible a straight-line gradation of particle sizes, so that the particles will pack as tightly as possible. Fourth, we want

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the least possible water-cement ratio consistent with workability, and to this end good gradation of particle size from the finest cement grains to the coarsest aggregate is helpful. Fifth, we want to avoid the use of aggregates which are characterized by more than 10 percent of pore space, or capillary channels, smaller than about  $5\text{ }\mu$  in diameter, if these spaces are already filled with water, or we want to adopt construction or curing methods which will permit their drying out.

The object of the coarser cement grains, or very fine grains of puzolanic, silica, limestone or dolomite is twofold. They serve mechanically to fill the interstices between the sand grains in the mortar, and they act as nuclei for crystallization of the amorphous constituents of the concrete. In other words, they are "seed crystals," with which colloid chemists are familiar. One method of promoting crystallization of a colloid sol or a gel is to plant seed crystals in it, because crystals show a preference for the adsorption of colloids. This is the manner in which mineral crystals in Nature grow in size. I presume many of you have seen grains of filter sand removed from a water filtration plant which had more than doubled in diameter from the adsorption of silica and possibly other minerals colloidally dissolved in the water that was filtered. The effect of a puzolanic is probably to adsorb both some of the hydrated lime and silica colloids loose in the concrete matrix, and thus grow crystals which fill the pores and interstices. Flotation experts have found that even pulverized quartz will adsorb enough lime, or calcium ions, to change the electrical surface charge from negative to positive. The right amount of calcium adsorption will neutralize the charges on the quartz particles and cause agglomeration.

I think we can see now why some of the older, slower acting portland cements were better than the higher limed and more finely ground present-day cements, if the concrete is to be subjected to severe weathering or corrosive sea or alkali waters. The coarser, underburned ingredients served some useful purposes in promoting crystallization and reducing porosity of the kind we now know must be avoided in both aggregates and set cement pastes. We do not have up to this time a clear-cut idea of what kind and how much porosity to avoid. The minimum pore size that appears to be harmless, from the work of the several investigators quoted, is in the neighborhood of  $5\text{ }\mu$ . The only low limit to pore size that is thought to be not harmful because of the adsorptive power of the solid containing this size of pore or capillary is the  $0.025\text{ }\mu$  for marble. Various colloid chemists have estimated the diameter of the pores of silica gel as from  $2\text{ }\mu$  to  $5\text{ }\mu$ , which is from  $0.002$  to  $0.005\text{ }\mu$ .

The silica gel has tremendous adsorptive powers, being able as a gel to hold 300 mols of water to one of silica. Thus the range of dangerous pore sizes appears to be from the molecular through the colloidal size range, as can be seen by reference to the table earlier in this paper.

### Conclusions

This paper is much longer than anticipated, and I could go on with references to Colloid Chemistry to justify some of my contentions. But to conclude in the fewest possible words:

1. Old concrete was often good because the end products were crystalline.

2. "Underburned" (by modern standards) and coarsely ground (relatively) cements helped promote crystalline end products.

3. Sand-cements (sand or siliceous material interground with cement clinker) helped promote crystalline end products, both by lowering the percentage of lime content of the cement and by providing seed crystals.

4. Other rock powders similarly interground or admixed with cement appear to help crystallization by adsorption of the colloidal products of hydration. Some rock powders also appear to help by dispersion of the cement particles thus providing better hydration and better distribution of the hydration products, so that less cement is required. They are not helpful if their use requires too much additional water.

5. Too much tricalcium silicate and/or tricalcium aluminate are harmful because they produce too much colloidal or amorphous material, of which the calcium hydroxide for various reasons is the most harmful.

6. If aggregates or cement matrix which produce concrete with more than 10 percent of pore and capillary spaces less than  $5\text{ }\mu$  in diameter must be used, they should be thoroughly dried out in the process of curing. In drying and shrinking the agglomerations of silica gel lose water, the walls of the cells and capillaries shrink, the pore spaces become larger, and air enters in place of the water. Therefore, once dried out the cell structure will not again adsorb as much water, or salt solutions as before because the pores remain partly filled with air or gases.

7. Avoid high water-cement ratios. P. H. Bates pointed out in the *Proceedings of the A.S.T.M.*, 1932, "that in a 6-bag per cubic yard concrete mix with 5 gal. of water per bag, if the cement actually combines with 20 percent of its weight of water (which is a liberal estimate, probably 15 percent is nearer right) some 13.6 gal. of the 30 gal. of water used would be removed, leaving 16.4 gal. of free water in the concrete. This is equivalent to 3800 cu. in. which is about one-twelfth of a cubic yard. This volume is only that originally occupied by

a part of the mixing water and is augmented by "air voids" and those resulting from the impossibility of filling all the interstices in the coarse aggregate with mortar and in the fine aggregate with cement paste." The worst of these water-filled voids is that they are probably most often of the dangerous pore and capillary size.

8. Bleeding and laitance from concrete mixes is not necessarily an evil because it helps dispose of some of this surplus water. The good old concretes prove this. It is evident that the particles of cement and aggregates are packing closely as they should.

9. Brown and Carlson in their paper already quoted remark on the extraordinary ability of the gel to extend itself by taking up water, so as to fill all the voids. But we know that the more water in the gel the more porosity it will have when it sets or dries out, also because of greater shrinkage the more interstices between aggregate particles. Therefore we want as concentrated a gel as possible. The ideal cement would be one that supplies fresh gel to fill the voids in the old gel as it shrinks, and one that promotes crystallization of the gel as it ages. That would be a cement that hydrates slowly, either because it has some relatively coarse particles, and/or because of its dicalcium silicate content. Moreover, the slowly forming new gel and crystallization of the aged gel, is making continuous use of the water squeezed out of the aging gel. Thus eventually, by pressure and shrinkage, we would arrive at a hardened cement paste more akin to quartzite than to chert; in other words, it would be completely crystallized.

That the dicalcium silicate serves this end better than the tricalcium silicate, we conclude from the following observation of R. W. Carlson, in his paper "The Chemistry and Physics of Concrete Shrinkage," *Proceedings of the A.S.T.M.*, 1935: "The shrinkage of concrete upon drying is governed by the gelatinous constituents in the cement. Hydrated cement contains minutely porous calcium silicate gel, the amount of which increases with the age of hydration, and is greater for higher water-cement ratios and for finer cements. The amount of gel also depends upon the chemical composition of the cement; fully hydrated dicalcium silicate is mostly gel, while hydrated tricalcium silicate is somewhat more than half gel."

The difference then is that half the tricalcium silicate is converted to gel within a matter of days, and the dicalcium silicate, as we have noted in the preceding quotation of Brown and Carlson, is only one-fourth hydrated in one year. The other half of the tricalcium silicate content is evidently

(Continued on page 141)

## Acceptable Aggregates From Low-Grade Deposits

THE RUNWAY PROJECT construction at Rivers, Manitoba, is believed to have the strongest pavement built to date in Canada. It is also the first to be designed and constructed by the Royal Canadian Air Force. This paper describes the method used by Royal Canadian Air Force engineers to make high quality concrete aggregates from low quality local gravels obtainable near the airport.

The requirements stipulated surfaces capable of supporting 180,000 lb. aircraft; 6000 ft. long and capable of extension to 10,000 ft; width to be 200 ft, with 50-ft. shoulders to support 40,000-lb. aircraft. The site had been a navigation school during the war and had three asphalt runways of low bearing value, taxi strips and aprons. These existing pavements were to be removed if necessary, or retained for continued use by light aircraft.

### Alternative Sources for Aggregates

The concrete runway system, when fully completed, will require a specified total of 120,000 cu. yd. of concrete. The closest commercial source of suitable natural aggregate was Birds Hill near Winnipeg, a rail distance of 165 miles. The freight rate on gravel was \$2.51 per cu. yd. with prospect of a further increase. Transportation was a major item in the cost estimates. To keep costs down, engineering curiosity was directed to the treatment of local gravels with the hope that a method could be devised to make this material suitable for concrete.

In general, the agricultural part of Manitoba west of Winnipeg, and extending into Saskatchewan, has scattered sand areas containing small and medium deposits of gravel. These are not water sorted gravels and the deposits contain a variable amount of harmful shale. Deposits in the vicinity of Rivers contain approximately 2 percent of shale in the plus 1-in. range, 5 percent in the 1-in. to 10 mesh range and 20 percent in minus-10 mesh range. These deposits also contain a small amount of rotten granite and a minor amount of drip coating in the upper portions, caused by evaporation from the underside of the pebbles. The remaining constituents are

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and J. D. SHANNON\*

hard granite, quartz and silicified limestone.

Preliminary testing indicated that the crushing and screening operation necessary with any process of separation would reduce the rotten granite to competent sand particles, because the weakness was on the grain boundaries. At least it would reduce it to a fine sand fraction that could be wasted if necessary. It also appeared probable that the weaker coatings would be removed in this manner, and that the stronger coatings would have no ill effect. The main problem was therefore the removal of the shale.

The Birds Hill aggregate is principally a medium limestone. Preliminary tests indicated that 4500 p.s.i. concrete could be made from this material, and it was used for most of the 1948 season. However, the flexural strength on test did not maintain the

normal ratio to the high compressive strength, reaching only 630 p.s.i. at 28 days. It was noted that the normal break was across the coarse aggregate, indicating that the low flexural strength reflected weakness in the aggregate. Birds Hill could supply only 1 1/2-in. maximum size, whereas the size required is 2 1/4 in.

The search for a method of eliminating shale was therefore encouraged by the probability that the harder constituents of the local gravel would make a stronger concrete, and by the evidence that 2 1/4-in. maximum aggregate could be obtained.

### Heavy Media Separation

The obvious basis for elimination of shale was specific gravity. The shale has a specific gravity of 2.9, while the usable minerals have a specific gravity greater than 2.6. Attention was directed, therefore, to a separation based on this characteristic, specifically to the sink-float or heavy media type of separation.

The process of separating coarse minerals by difference in specific gravities, using a finely ground heavy mineral suspension in water to simulate a heavy liquid in which one mineral will float while another sinks, has become fairly well known to the mining industry during the last fifteen years. It is still, however, a new process, perfected during the last few years, and now being adopted on a large scale for cleaning coal and raising the grade of iron ores. Lately, it has proved its value to small mining enterprises treating coarse ores. This project is the second to use the process in Canada; it is the first anywhere to use the process on material of such low initial value as gravel. It was estimated that gravel would have two advantages over coarse ores in the process, in that the rounded shapes would allow easier flow and that there could be no accumulation of middlings in the cone.

The heavy liquid processes use either magnetite and ferrosilicon, or galena, as heavy mineral, since these are easily recovered by magnetic separation or by flotation. It was decided to use the magnetite process because of the present high cost of galena, the relative indestructibility of magnetite, and because of the possibility that even tiny amounts of lead sulfide may have an ill effect in concrete.

### INTRODUCTION

\* This article is reprinted from the April, 1949, issue of *The Engineering Journal (Engineering Institute of Canada)* and describes the first full-scale application of the heavy-media method to the beneficiation of gravel. Cost data indicate that this process of separating unwanted particles from a gravel matrix was economically possible due to the freight rate penalty on this project. Similar conditions exist in the United States, to greater or lesser degree and the process could well be the solution to high freight rates or to meeting specifications and staying in business in some localities. The materials to be separated need only have a .01 difference in specific gravity to be amenable to the process.—The editor

\*Squadron Leaders, M.E.I.C. and Air Materiel Command, R.C.A.F., respectively.

## BENEFICIATION



Mobile heavy media separation plant beneficiating gravel for use in building concrete air strips in Canada

A deposit of suitable gravel was discovered in the fall of 1947 about four miles from the airport. After completion of exploration and preliminary tests, Maintenance Command, which controls construction for the R.C.A.F., authorized the forwarding of a 1000 lb. average sample to the laboratory of the American Cyanamid Co. at Stamford, Conn. The result of tests was received in April of 1948. For these tests, the minus-10 mesh fraction, which cannot be treated by the standard heavy media process, was eliminated. An evidently complete elimination of shale was easily obtained in the plus-10 mesh portion, using only magnetite and a specific gravity of 2.43. The screening operation to eliminate the minus 10 mesh also effectively disposed of the rotten granite and weak coatings. Approximately 80 percent of concrete aggregate is plus 10 mesh. The major part of the problem was consequently believed to be solved.

The processed gravel returned from the laboratory was forwarded to Milton Hersey Co., Ltd., at Montreal for a concrete test. As it was considered probable that minus-10 mesh sand could be obtained only from the Birds Hill deposits, sand of this type was used with the process gravel to make concrete test batches. The results showed a density of 156 lb. per cu. ft., using a cement content of 6.7 bags per cu. yd. and a water-cement ratio of 0.47. Compressive strength was 4170 to 4300 p.s.i. at seven days, and 5600 to 6300 p.s.i. at 28 days. Flexural strength was 585 to 660 p.s.i. at seven days, and 780 to 855 p.s.i. at 28 days. An abrasion test on the gravel showed about the same as for the Birds Hill material, but the soundness test was considerably better, the weighted average loss after ten cycles of soundness test being approximately 3.0 percent.

### Equipment and Plant

On the basis of the above results and the obvious large saving in expense evident from estimates, a recommendation was made to Maintenance Command that the necessary equipment be acquired immediately. It was obvious that construction could not be delayed until the equipment was assembled and in smooth operation, but it was considered that this process could supply a part of the aggregate for 1948 and all of the plus-10 mesh portion for 1949. With this plan in mind, Maintenance Command arranged promptly with A.F.H.Q. and National Defense for the immediate expenditure of \$50,000 in U. S. funds.

The equipment ordered was an HMS (heavy media separation) Mobil Mill size 2M manufactured by the Western-Knapp Engineering Co. of San Francisco. It consists of a structural steel framework with the necessary equipment mounted, the whole being semi-portable. About six days are required to complete the bolted assembly, with a crew of six men. In this case, assembly was delayed because of the slowness in delivery of magnetite, which had to be ground to a close specification, and was obtainable only in the United States with some difficulty. Assembly was completed and test runs were started on August 27, under the supervision of Graham Eby, engineer for the North American Cyanamid Co. of Toronto.

The plant is erected at the gravel pit. The gravel is mined by shovel or Carryall and dumped in a shallow hopper, whence it is delivered by a feeder mechanism onto an elevating belt discharging on a Cedarapids vibrating screen in combination with a 36-in. jaw crusher. This all is standard contractor's equipment. The oversize is reduced to 2 in. and the undersize, below 10 mesh, is eliminated by wet screening. The prepared feed

from this preliminary plant is delivered by belt to a 7-ft. inverted cone at the Mobil Mill, where it is immersed by height of fall in a medium consisting of ground magnetite, kept in partial suspension in water by slowly revolving arms. The shale portion floats on the medium and is moved by slow centrifugal force to a tangential overflow launder, which conveys it to a 36-in. Allis-Chalmers vibrating screen. The heavy portion of the feed sinks through with the medium to the inverted apex, thence down a 5-in. square pipe to an air lift, which elevates it to the Allis-Chalmers screen. It requires about five seconds for material to pass through the cone to the screen. Both sink and float products are fed to either side of a longitudinal divider on the same screen. Ten mesh ton cap screen is used.

The plant was erected seven weeks before the end of the season. Of this time, only four weeks was available because the crushing and screening plant was otherwise in use. Operation on a three-shift basis was confined to the last ten days of the season. A total of 5500 cu. yd. of aggregates was produced.

### Plant Operation

The bulk of the medium is drained from the products at the top end of the screen and returned to the cone through a circulating pump. The remaining magnetite is drained and washed from the products by water sprays and passed to a magnetic separator, which eliminates sand and clay that have entered the circuit. The cleaned magnetite is then pumped to a densifier, which is a screw-type classifier in which the helix can be raised or lowered as desired. This item of equipment serves to dewater the magnetite and to store it or feed it back to the circuit as desired. In passing back to the cone, the magnetite falls through a demagnetizing coil, consequently the particles of magnetite do not flocculate in the cone. A small motor generator for the coil, and a compressor for the air lift, are the remaining items of equipment. A flow sheet is shown here.

The aggregate side of the screen has been double-decked, and an apron screen added, so that the product is divided into three sizes as required for proper proportioning at the concrete mixer. The shale product is wasted, but may be of use as a binder in gravel surfaces. Rotten granite and weak coatings are eliminated by the crushing and screening process. Water and power are required to operate the equipment. Electric power was obtained from the Manitoba Power Commission at a distance of one-half mile. The Mobil Mill requires 65 hp.

The gravel deposit rests on clay at a depth of 13 ft. As the pit enlarged,

## BENEFICIATION

reservoirs were excavated in the clay and the seepage, which is small in this semi-arid climate, is yet enough over the large area of the excavations to make up all lost water. All wasted water with its sand and clay content is returned to the pit and loses most of its burden before entering the pools. The water supply pump is placed at the clear end of the reservoirs. The Mobil Mill can operate satisfactorily at less than 200 gal. per cu. yd. of product, but approximately four times this amount is required in wet screening to eliminate the minus-10 mesh and launder it back to the pit. The actual loss of water is simply the difference in the water content of the products as mined and as delivered to the bins.

### Development of Process

Initial operation of the plant was not smooth. In addition to shortage of water, due to underestimating the pump capacity required for elimination of the minus 10 mesh, and due to the small size of excavation when the pit was started, there was serious delay in delivery of the fine screens. There was also a difficulty in finding suitable minus-10 mesh sand at Birds Hill. For these reasons, it was decided to eliminate minus  $\frac{3}{8}$ -in. material until these difficulties were overcome. This required only dry screening and the screens were available. The plant operated successfully on this basis for three weeks. During the last week of the season in October a source of minus-10 mesh sand was found, and water, pump and screens were available. The plant was therefore changed to treat plus 10 mesh again and operated with complete success.

The plus  $\frac{3}{8}$ -in. aggregate was used in concrete with sand from Birds Hill

for two weeks at the end of the season. It was noted that the concrete finished much better than formerly, though the maximum size was now  $2\frac{1}{2}$  in. instead of  $1\frac{1}{2}$ . There was a small increase in compressive strength, the average of 12 cylinders of the mixed aggregate being 4813 p.s.i. at 28 days, as compared to 4623 p.s.i. for the same number of cylinders of Birds Hill aggregate under nearly identical conditions.

Operation of the Mobil Mill showed that it does not require an even rate of feed. Sudden changes from no load to full load did not affect the clean separation of the shale. For prolonged shutdown, the magnetite is stored partly in the densifier and partly in the hopper beneath the screen. For a shutdown of several hours, it is most convenient to leave the cone circuit in operation at a slow rate. In case of power failure, perhaps 20 minutes may be required to get the magnetite into suspension again. Plugging of the cone or air-lift from any cause is relieved by opening the gate at the airlift and dumping, or partly dumping, the contents of the cone into a sump. The process is essentially simple and nearly foolproof, so trouble is rare.

Subsequent to the initial tests at the Stamford laboratory, a test was made on the discarded minus-10 mesh sand, to see if the shale portion could be eliminated. The "Dutch State Mines Cyclone" was used for this purpose. For the test, the sand was mixed into the same magnetite medium as used in the heavy media test. It was then pumped under pressure, entering tangentially into a small inverted covered cone. There is no mechanism in this cone, the separation being based on centrifugal force and specific gravity. The heavy sand is drawn off continu-

ously from the bottom apex and the shale is forced out at the top through a pipe at the center.

A good separation was obtained without difficulty and the cleaned sand was tested for concrete by Milton Hersey Co., Ltd. They reported it as very satisfactory. However, considerable capacity in magnetic separators is required, in order to recover the magnetite from the sand products, and these separators were not available. Fortunately, in September, a deposit of water-sorted sand nearly free of shale and of the right grading was found on a small hill in the middle of the Assiniboine valley 12 miles from the Airport. At the end of the season, 17,000 cu. yd. of this sand were mined, transported and stockpiled at the airport for 1949 operations. This sand will be 20 percent of total aggregates and has averaged in tests 0.15 percent of shale and 4 percent silt and clay. Because the coarser aggregates are washed in processing the average of the whole aggregate will be 0.03 percent shale and 0.4 percent silt and clay.

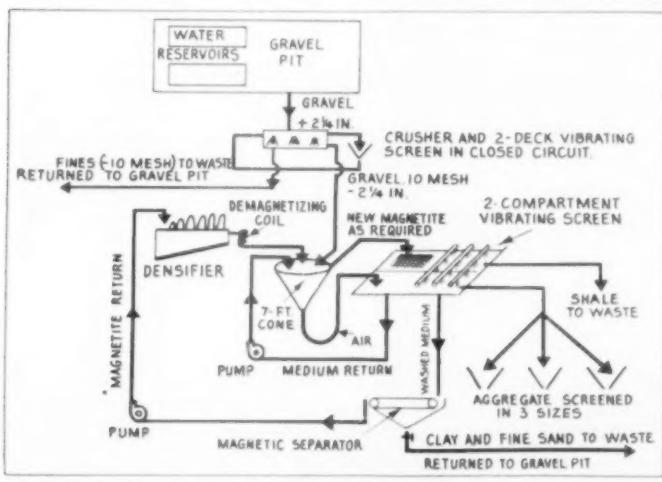
The Mobil Mill occupies a space 28 ft. long, 16 ft. high and 14 ft. wide. This comparatively small plant produced without difficulty in normal operation 20 cu. yd. per hour of aggregate. Capacity of the cone and screen was not reached at any time. At one time the capacity of the magnetic separator to remove slimes and fine sand from the circuit was reached, but examination of the pit at this time showed that the clay overburden was not properly stripped.

### Economy of Operation

The normal operating costs of the Mobil Mill are easily estimated. Only one operator is required and a week of training is sufficient. The only tests required are for the specific gravity of the medium at the top and bottom of the cone. With such a considerable difference in specific gravity between the shale and aggregate, supervision is easy. The plant requires 65 hp. in electric motors. The magnetite loss is less than  $\frac{1}{2}$  lb. per cu. yd. of aggregate produced. Disregarding lost time, these costs total about 7c per cu. yd. on this project. It is estimated that screen life will range from 5000 to 10,000 cu. yd. Pump liners will probably be required every 20,000 cu. yd.

It is expected that total operating cost during the coming season will average close to 10c per cu. yd. Write off of the plant cost is estimated at 5c per cu. yd. Patent costs are in the form of a royalty on production payable to the American Cyanamid Co., which acts as agent for the patentees. The major costs in the project are mining of the gravel, the initial crushing and screening operation and

(Continued on page 144)



# Calcining

## Thermodynamics of Lime Manufacture

Time and heat factors thoroughly considered along with heat losses; operation of a "perfect" kiln presented as a guide for study

ALTHOUGH the thermodynamics of lime-burning is not too complicated or involved for the average engineer to understand, it seems that the use of this science has been grossly neglected or completely ignored by the engineers and laymen who have dabbled in the development of lime-burning equipment. Misunderstandings, misconceptions, and downright ignorance have resulted in some very poor arrangements for calcining, or purporting to assist in the calcining, of lime. On the surface, many of these contrivances seem to have merit. That the device did not live up to its expectations and meet the hopes of the inventor and sponsor is quite understandable when the device is examined in the light of reason and understanding of the basic principles involved. Many of these contrivances are like the perpetual motion machines forever being conceived by ambitious but unlearned enthusiasts. They look like they should work—but don't. And many a dollar deserving a better fate has been pulled out of the treasury of a gullible lime producing company to be lost forever on the plant scrap-heap, or retained as a piece of folly to plague the operating crews.

### Fundamentals Involved

There are but two fundamentals involved in the thermodynamics of the lime-burning process. These are *time* and *heat*. It will be noted that the word *temperature* is not used here. Temperature is only a measure of the levels at which the addition or subtraction of heat is effected. It usually is the faulty association of temperature with heat that results in many of the prevailing misunderstandings and misconceptions concerning the general problem.

It is not true to say that calcium carbonate is calcined by 1650 deg. F. of heat. It is true to state that when heat is applied at 1650 deg. F., calcium carbonate will form lime. Temperature itself never calcined one molecule of lime. It is the heat that does the calcining. The temperature simply indicates the relative level at which heat is being worked with.

Time, of course, is an element of problems involving a rate. Time is one of the fundamentals of our problem, our practical problem of produc-

ing lime commercially, since it involves the rate of production. All chemical actions and reactions require the element of time for their conduction. Some need but a very small period of time for completion while others may require very long periods of time. An explosive reaction is one requiring very little time for completion. The setting of portland cement concrete requires months to approach completion. In the case of calcining limestone, time is required to force the heat into the particle being calcined. When the heat is sent into the particle slowly, more time is required than when the heat is sent into the particle quickly.

Thus *time* and *heat* are the fundamentals of the problem of producing calcined material commercially.

As mentioned before, *temperature* is a measure of the level at which we are dealing with quantities of heat. *Temperature is not a quantity. It is a quality.* The temperature indicates only the energy level of the substance, and not the energy itself.

As in the case of fluid flow, heat will flow only from a higher level to a lower level. In other words, heat may be transferred only by passing from a higher to a lower temperature level. Thus, in certain cases, we can use *temperature* to measure the quantity of heat-flow from one body to another, or to measure the quantity of heat in a body.

### Heats Involved

The heat involved in thermodynamic processes is divided into two classifications for the purpose of accounting satisfactorily for its disposal. These two classifications are termed *sensible heat* and *latent heat*.

In the case of water at atmospheric pressure, the temperature rise from 70 deg. F. to 212 deg. F., when heat is applied, is an indication of the amount of heat added to the water, and is termed the *sensible heat*. Thus the quantity of heat introduced into the water can be determined by the temperature rise. Upon the addition of further heat, the temperature of the water will remain at 212 deg. F., but the water will boil and be converted to vapor. This heat that is con-

verting the liquid water to water vapor is called the *latent heat*. The thermometer is useless, in this case, as a device for measuring the further input of heat to the water.

The lime calcining process involves the same principles as those for water. The calcareous material is introduced into the process at atmospheric temperature. Heat is added and the temperature of the raw material is raised. This is the sensible heat.

If the kiln feed is dry, or reasonably so, the temperature of the particles will continue to rise until 1650 deg. F. is attained. The core of the particle will remain practically constant at this temperature until it is converted to lime. Due to the fact that the structure of the stone may be such that the passage or release of the dissociated gas is highly impeded, pressure may be built up within the particle so that the temperature is higher.

If the kiln feed is a calcareous slurry, the temperature will rise to 212 deg. F. and remain practically constant until the water has been evaporated, when the temperature again rises until the dissociation temperature, about 1650 deg. F., is attained.

When the particle has been completely, or almost completely calcined, the core temperature will rise once more; but the particle now is no longer calcium carbonate; it is lime. The heat that is applied to convert the calcium carbonate at 1650 deg. F. to lime at 1650 deg. F. is the latent heat of dissociation.

### Dissociation Heats of Calcium Carbonate

The sensible heat in calcium carbonate can be computed easily. This is derived by obtaining the products of the mass, the specific heat, and the temperature rise. Thus with calcium carbonate being introduced into the process at 70 deg. F. and in raising its temperature to 1650 deg. F., the temperature rise is 1580 deg. F. The specific heat of calcium carbonate is approximately 0.25, and to raise each pound of calcium carbonate from 70 deg. F. to the dissociation temperature of 1650 deg. F. will require:

$1 \times .25 \times 1580 \text{ deg. F.} = 395 \text{ B.t.u.}$   
 $\text{or } 395 \text{ B.t.u.} \times 2000 \text{ lb.} = 790,000 \text{ B.t.u. per ton of calcium carbonate.}$

The latent heat of dissociation of

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calcium carbonate is about 781 B.t.u. per lb. or

$781 \times 2000 = 1,562,000$  B.t.u. per ton of calcium carbonate.

Since it is more convenient and less confusing to base such computations on the product rather than on the raw material, the above values must be converted to correspond with equivalent values for lime instead of calcium carbonate. Approximately 40 percent of the calcium carbonate is carbon dioxide that is expelled during the calcining operation, so that the lime product contains only 60 percent of the original. Thus the sensible heat, and the latent heat of dissociation become, for each ton of product:

$$(\text{Sensible heat}) 790,000 \times \frac{100}{60} = 1,320,000 \text{ B.t.u. per ton of product;}$$

$$(\text{Latent heat}) 1,562,000 \times \frac{100}{60} = 2,600,000 \text{ B.t.u. per ton of product.}$$

### Practical Considerations

In practice, however, it is not possible commercially to calcine at 1650 deg. F. since the time required to do the job would be too long. Neither does it appear advisable to exceed some optimum maximum temperature either because of the danger of rendering the product inferior by over-burning or dead-burning. In most cases an optimum temperature of 2300 deg. F. to 2400 deg. F. is indicated as producing the best quality of lime within a reasonable period of time.

As a consequence, the lime, originally calcined at about 1650 deg. F. must be raised to approximately 2350 deg. F. or thereabout. This is a further requirement of sensible heat so that:

$$2000 \times .25 \times (2350 \text{ deg. F.} - 1650 \text{ deg. F.}) = 350,000 \text{ B.t.u. per ton of lime.}$$

Summing up the barest heat re-

quirements for preheating, calcining, and superheating, then, there is:

Preheating	1,320,000 B.t.u. per ton lime
Calcining	2,600,000 B.t.u. per ton lime
Superheating	350,000 B.t.u. per ton lime
Calcining heat requirement	4,270,000 B.t.u. per ton lime

From the above figures it is readily seen that the two heat requirements, for calcining and superheating, when combined constitute approximately 69 percent of the calcining heat requirement. Furthermore, these predominant heat requirements are demanded at the highest temperatures involved in the processing of the material proper. The significance of these facts is that which predominantly has been misunderstood or ignored by most ideas in the lime industry to recover waste heat by driving it into the raw material. This feature will be discussed in detail subsequently.

### Heat Losses

Unfortunately, the heat developed by combustion for the processing of the material cannot be applied exclusively to the bare calcining heat requirements.

The well-designed shaft kiln can be made to function with a high thermal efficiency. On the other hand they are difficult to control and to operate constantly at their highest thermal efficiency. Also, more labor is required in the overall operation.

The rotary kiln, on the other hand, is less efficient thermally, but it has tremendous advantages in the greater ease with which it can be controlled with a minimum of labor.

The heat losses from the process are found at three places: in the discharged lime, through the confining walls of the kiln, and in the gases leaving the process.

In supplying heat to make up for the losses of the first two, the third heat loss ordinarily is increased.

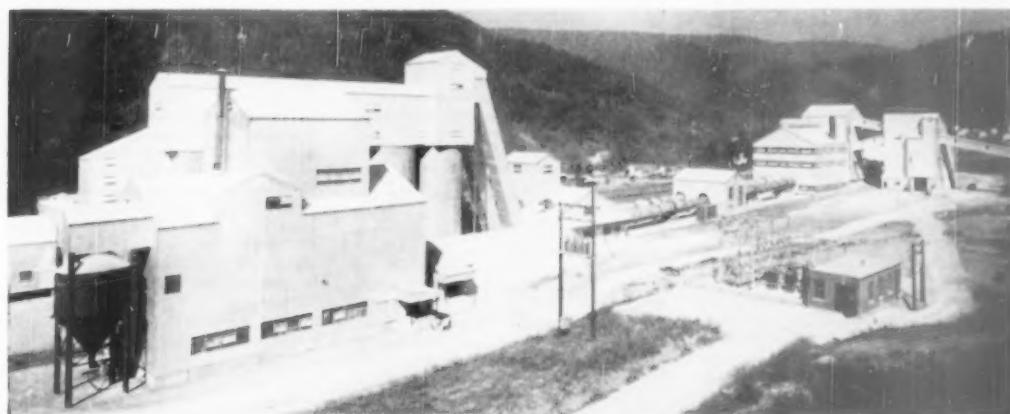
With bituminous coal used as fuel, the coal requirement is increased to supply that heat which is not applied directly to the complete calcining process. This is a serious cost-penalty in many plants, and it is this waste of heat that has intrigued so many engineers and inventors into the development of devices for the alleged purpose of conserving or recovering this wasted heat. In most cases these zealous developers have attacked the problem with more enthusiasm than knowledge.

Nevertheless, by the costly processes of trial and error, some progress has been made along the lines of reducing heat waste. Recuperation of heat from the product as it is discharged from the kiln commonly is practiced. In this manner a properly designed "cooler" may recover 50 percent of the heat in the discharged material and return it to the process in the form of preheated air for combustion. Insulating the kiln shell is being appreciated increasingly. But the successful device to recover useful heat from the kiln gases and return this heat to the process in the form of heat has yet to be developed.

### Heat in Discharged Product

Only sensible heat remains in the discharged product after it has passed through the calcining process. Ordinarily this material is discharged at a temperature within a hundred or so degrees of its maximum temperature. Thus it is common practice to pass this material from the rotary kiln into the cooler at a temperature of from 2000 deg. F. to 2200 deg. F. Those who place a retaining dam at the discharge end of their rotary kilns will find that they will discharge the material at a lower temperature than when the kiln is unobstructed.

Simply, as an example, it can be assumed safely that the material dis-



Rotary kiln lime plant is typical of trend to use of large capacity efficient operations

## CALCINING

charged from the kiln will be at 2000 deg. F. Then the sensible heat contained in it will be:

$$.25 \times 2000 \times (2000 \text{ deg. F.} - 70 \text{ deg. F.}) = 965,000 \text{ B.t.u. per ton.}$$

If all this heat was recovered in a practical kiln operation, it would mean not only a saving of 71.5 lb. of coal per ton of product, but it would reduce also the heat lost in the exit kiln gases. Why this is so will be discussed later. It is indeed surprising that more effort isn't expended in developing more efficient devices for recovering this heat.

Let us see to what temperature this heat would raise the air for combustion. In order to make this computation, some arbitrary product-fuel ratio must be assumed. A ratio of 3:1 is common. That is, 667 lb. of coal per ton of product. Proper combustion requires about 10 lb. of air per lb. of coal. Thus to produce one ton of product requiring 667 lb. of coal will mean that 6670 lb. of air are required. So:

$$.26 \times 6670 \times (X \text{ deg. F.} - 70 \text{ deg. F.}) = 965,000 \text{ B.t.u.}$$

$$\text{or } X = 627 \text{ deg. F.}$$

Even with our modern though inefficient coolers, where as much as 50 percent of this heat is recovered, the saving is appreciable. There is no doubt but that an efficient cooler-recuperator that will function economically can be designed.

### Kiln Shell Heat Loss

The commercial manufacturers of heat insulation have done a good job developing products and means of applying them to reduce the heat loss through the rotary kiln shell. This heat loss may average, on an uninsulated commercial rotary kiln, as high as 400 B.t.u. per hr. per sq. ft. of kiln shell surface. If the kiln shell is 8 ft. dia. by 150 ft. long, there are 3770 sq. ft. of shell surface. This means that the heat loss may reach

$$3770 \times 400 = 1,508,000 \text{ B.t.u. per hr.}$$

When the kiln has been properly insulated, which can be done easily beyond the high-temperature zone, this loss can be reduced to 140 B.t.u. per sq. ft. per hr. or

$$3770 \times 140 = 528,000 \text{ B.t.u. per hr.}$$

Reducing this heat loss through the shell also will help in reducing the heat lost in the kiln gases.

There are those rash individuals who make the ridiculous assertion that by reducing the kiln shell heat loss the only thing accomplished is to increase the heat lost in the kiln gases. It is true that the *temperature* of the kiln gases *may increase*, but the *heat loss actually is lowered*. Here again is a point where temperature is confused with heat. This seeming contradiction of a higher temperature but a lower heat loss can be explained by the fact that the quantity of gas has been lowered. It is by such mis-

conceptions and misunderstandings, where temperature is confused with heat, that the ignorant are leading the unwary astray.

### Kiln Gas Heat Loss

In the kiln gases normally is wasted that heat incapable of being absorbed by the raw material under the conditions existing, and that waste further compounded by the folly of ignoring, or at best slightly modifying, the heat lost in the product and through the kiln shell. The heat lost in the kiln gases largely is the sum of all the misapplications, and neglects, and mismanagement from which the kiln may be suffering. It is to the recovery of the heat from the kiln gases that the engineer and the inventor are drawn as though by a magnet. Probably this is because of the false sensing of tremendous heat that awes the average human being who views the spectacular phenomenon of flame. But like many other misunderstood and awe-inspiring phenomena, this flame, this rushing body of hot gas and dust, isn't all that it seems. It is simply an accumulation of the conditions attending the peculiarities of the process, also enhanced by the earlier evils that have been thrust upon it. And, too late, attempts are made at this point to rectify the former misdeeds.

A pound of hot lime as it is discharged from the kiln at 2000 deg. F. occupies a volume of less than a pint and holds 483 R.t.u. of heat. A pound of kiln gas at 1400 deg. F. occupies a volume of about 52.5 cu. ft. and holds 343 R.t.u. of heat. A pint of hot lime seems almost insignificant compared to the greater bulk of hot gases, and we are impressed and go to work on them. The only redeeming feature of this struggle to recover this heat is the fact that it is there. With a product-fuel ratio of 3:1, there are involved, in the making of one ton of lime, 6670 lb. of air, 667 lb. of coal that are largely burned to gas, and some 1300 or 1400 lb. of carbon dioxide from the calcining carbonate. This is a total of some 8700 lb. of gas to make 2000 lb. of lime. Thus for every 4.5 lb. of lime produced, there are about 4.5 lb. of gas.

### The "Perfect" Kiln

Although the perfect kiln, like the perpetual motion machine, can never be realized fully, let us assume that we do have a kiln that has no shell loss, and that we can recover *all* the heat in the lime discharged from the kiln.

From our earlier figures, it is seen that we must supply, for each ton of lime produced, a minimum of 2,950,000 B.t.u. of heat. This is composed of the latent heat of dissociation, and the sensible heat of superheating. We must have these supplies of heat

to make lime at a commercial rate. This heat will be termed "high-temperature heat" since we must have it at these elevated temperatures to be effective. This heat cannot be had from any source other than primary energy. Coal, or its equivalent in heating value, must be used. Now, how much coal does this heat requirement actually represent?

With a good grade of bituminous coal having a heating value of 13,500 B.t.u. per lb., the seeming minimum coal requirement will be:

$$2,950,000$$

$$----- 218 \text{ lb. of coal per ton}$$

13,500 of lime. This, however, ignores the fact that "high-temperature heat" and not the total heat in the fuel is available. This is one of the salient features that must be borne in mind continually. Only that heat which is above 2300 deg. F. is available and useable substantially in this part of the kiln.

We must attack this element of our study in a rather roundabout fashion. The results, nevertheless, will be completely valid.

The theoretical flame temperature, when burning the type of coal postulated, will be about 4500 deg. F. when using 10 lb. of air per pound of coal. The heat between this temperature and 2300 deg. F. is all that is available to the calcining and superheating process. Thus:

$$(4500 \text{ deg. F.} - 2300 \text{ deg. F.}) \times .27^*$$

$$\text{times } X = 2,950,000 \text{ B.t.u.}$$

X = 4950 lb. of combustion gases.

\*The specific heat of the gases increases slightly at these high temperatures.

Each pound of coal and the 10 lb. of air for its combustion will produce approximately 11 lb. of gas and incandescent, heat-bearing particles of dust. Consequently the coal requirement will be:

$$4950$$

$$----- 450 \text{ lb. of coal per ton of lime.}$$

11 With these gases of combustion and that from the calcining material, a total of 4950 plus 1340 or 6290 lb. of gas are involved in producing one ton of lime.

These gases leave the active calcining zone at a temperature not less than that of the superheated coating of lime on the particles, or 2300 deg. F. Thus, as these gases leave the zone of active calcining, they hold a fixed amount of heat. This heat quantity will be:

$$.26 \times 6290 \times (2300 \text{ deg. F.} - 70 \text{ deg. F.}) = 3,650,000 \text{ B.t.u. per ton of lime.}$$

Earlier it was shown that the sensible heat requirement for preheating the charge is 1,320,000 B.t.u. per ton of lime. From a comparison with the above figure, it will be noted that there is more than enough heat available in the gases to do this preheating since there are 3,650,000 B.t.u. of low-

## CALCINING



A total of 118 commercial lime plants are shown on this map, recently published by the National Lime Association. Vertical kilns are upright kilns, including standard and large capacity gas-fired vertical kilns, mixed feed, Ellerman, fluo-solids, and pot kilns. Rotary kiln plants are those plants operating one or more rotary kilns. Many of the rotary plants indicated also operate vertical kilns. Excluded are dead-burned dolomite plants and extremely small pot kiln plants that operate sporadically and on a local basis.

temperature heat available for a 1,320,000 B.t.u. low-temperature heat requirement. The surplus of heat is 2,330,000 B.t.u. This surplus heat will pass out of the kiln with the gases at a temperature of:

$$.26 \times 6290 \times (X \text{ deg. F.} - 70 \text{ deg. F.}) = 2,330,000 \text{ B.t.u.}$$

$$X = 1470 \text{ deg. F.}$$

The heat recoverable from the lime in the cooler, we must remember, hasn't yet been added. When this is done, it is ordinarily assumed there will be 965,000 B.t.u. added to the heat in the kiln gases. This would show itself as a still higher temperature. Thus, with the perfect kiln, and utilizing within the process every possible quantity of heat, it might seem that the kiln gases would leave the process at a temperature nearly 2000 deg. F. But this isn't so.

When we add to the air for combustion the heat from the lime in the cooler, this heat relieves the coal of some of its burden in raising the temperature of the air for combustion. It means that we can deduct 965,000 B.t.u. equivalent to coal, or

$$965,000 = 71.5 \text{ lb. of coal.}$$

$$13,500$$

In this manner the coal requirement is not only reduced, but the weight of

combustion gases is reduced also. Let's see what this has done for us.

Instead of requiring 450 lb. of coal, now we need only 378.5 lb. of coal per ton of lime. The air for combustion is reduced proportionately; only 378.5 lb. are needed. Summing up these new weights, then:

$$2785 \text{ lb. air for combustion.}$$

$$379 \text{ lb. coal.}$$

$$1340 \text{ lb. CO}_2 \text{ from the charge.}$$

$$5504 \text{ lb. gas total.}$$

$$\text{Then } 5504 \times .26 \times (2300 \text{ deg. F.} - 70 \text{ deg. F.}) = 3,200,000 \text{ B.t.u.}$$

Deducting that heat required to preheat the charge, there remains 1,880,000 B.t.u. to be wasted with the kiln gas. This is equivalent to

$$.26 \times 5504 \times (X \text{ deg. F.} - 70 \text{ deg. F.}) = 1,880,000 \text{ B.t.u.}$$

$$X = 1385 \text{ deg. F.}$$

Thus by adding the heat from the lime cooler to the process, the coal requirement was reduced which resulted in less heat being lost in the kiln gases. At the same time the temperature of the kiln gases was reduced by 45 deg. F.

The point to be made, however, is that this heat escaping with the waste gases can serve no further useful purpose at the feed end of the kiln. All the heat requirements have been sup-

plied, and this heat is in excess. Not until more high-temperature heat is available can this excess heat be used directly in the process, and this high-temperature heat must be had without increasing the use of fuel.

Since we have assumed the conditions of a perfect kiln, we can also assume that the heat in the gases can be returned to the only place where they will do any good; that is, assisting in the further development of high-temperature heat. And the only place where it can be applied practically is in the additional heating of air for combustion.

In an earlier section it was found that by extracting all the heat in the discharged lime and adding it to the combustion air, the temperature of the air was raised to 627 deg. F. Let us see what might happen if the air for combustion was raised to a still higher temperature by the kiln gases.

Obviously, if the benefits of using the discharged lime for preheating the combustion air are to be retained, the further heating of the air must be done between the cooler and the kiln. This means that the combustion air would enter the lime cooler, pass into the gas heat-exchanger, and thence to the kiln. Thus the air would enter

(Continued on page 143)

# Grinding

## ROD MILL OPERATION IN SAND PRODUCTION

**Development, costs of operation and methods of production using center discharge peripheral mills considered, as applied specifically to manufactured sand**

SINCE THE END of the war there has been an increasing tendency to produce manufactured sand in preference to natural sand for certain classes of construction. This has been brought about by a number of factors, the three most important of which are: (1) more stringent specifications, (2) decreasing reserves of satisfactory natural sand with an increasing lack of sand at localities where needed, and (3) the accumulation of stocks of gravel in sizes for which no market exists. The total tonnage of manufactured sand produced has also been increased greatly due to the fact that a number of large government dams are securing all of the sand for their construction from this source. As no natural sand was available on several of these jobs and since approved quarry rock was close at hand, it proved to be more economical to use the available quarries as a source of both coarse aggregate and sand.

It should be borne in mind that neither the rod mill nor any other crushing or grinding equipment can produce sand to compete with a natural sand, when a deposit contains sand which meets specifications or can be made to do so economically without the addition of manufactured sand.

The use of a rod mill for producing manufactured sand is not a recent application. The Sun Sand Co., Thaver, W. Va., installed a 4- x 10-ft. Marcy open end rod mill in 1925 and this mill is still in operation. This is believed to be the first installation of a rod mill for sand production and the material processed is a very hard, tough sandstone. The mill operates in closed circuit with a 16-mesh screen with undersize going to spiral rake classifiers in series, and produces a relatively low iron content sand for the glass trade. A 5- x 10-ft. Marcy open end rod mill has been operated for a number of years by the Decker Creek Sand Co. at Greer, W. Va., to produce glass sand.

In early 1940 an 8- x 12-ft. Marcy open end rod mill was installed at Shasta Dam near Redding, Calif., and this mill operated throughout the period of time required to construct

By DAVID P. HALE, JR.\*

the dam. It is now producing sand from pea gravel in the Radium plant of Henry J. Kaiser Co., Inc., near Pleasanton, Calif.

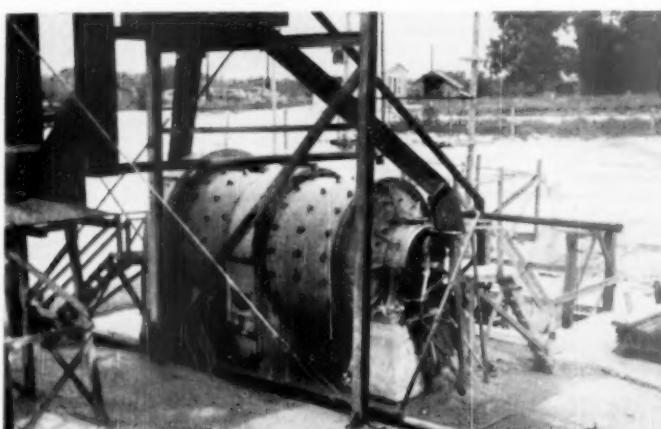
When the fine aggregate flow sheet was designed for Fontana Dam, one of the Tennessee Valley Authority projects on the Little Tennessee river, two 9- x 12-ft. high-discharge type rod mills were installed. These began operation in 1942 and furnished the sand for that project.

These installations show that the rod mill is not a new application for producing sand; however, the mills in use up until the end of the war were of standard open-end or high-discharge type construction.

For a number of years various writers in trade and technical journals have suggested that some of the machines used in ore dressing by the mining industry might well be adapted for processing fine aggregates. A number of machines which were primarily developed for metallurgical work, such as the classifier, hydro-separator and Doreco sizer, have found widespread use in processing aggregates. Since the adoption of these

machines to processing aggregates, many changes have been made in their construction to adapt them better for this particular type of work. In the case of a rod mill, all of the initial installations involved the conventional type mills and it has only been recently that a special type of mill known as the center peripheral discharge mill, or double-ended mill, has been available for sand production.

The center peripheral discharge type of rod mill was first developed in 1936 by collaboration between the American Potash and Chemical Corp., Trona, Calif., and The Mine and Smelter Supply Co., Denver, Colo. The problem which led to the development of the mill involved the grinding of a very friable pyroborate to obtain a final product all minus 20 mesh with a minimum of minus 100 mesh fines. Initially, an open-end rod mill was installed and a great number of schemes were attempted to decrease the amount of minus 100-mesh material produced. The rod charge was varied a great deal and grinding attempts were made using 3-in. plugged pipes and Shelby seamless tubing. During this test work some 3-in. rods were "spooled" (3-in. rods were milled down to 2 1/8-in. dia. except for a 4-in. length on each end) in an



This 8- x 12-ft. rod mill, with 5-in. pump, is being used on a government dam project

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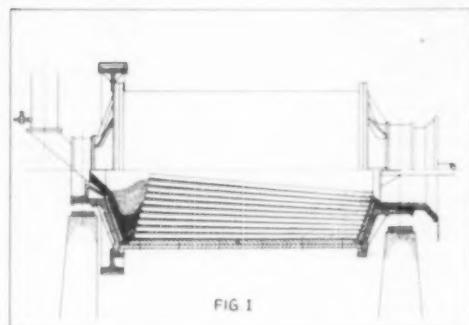


FIG. 1

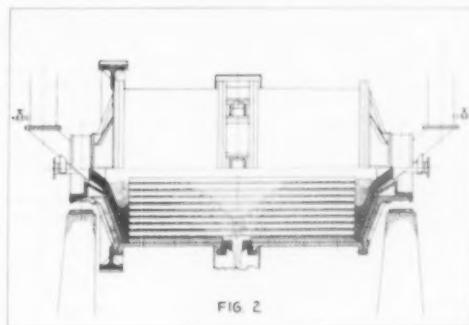


FIG. 2

Fig. 1: In conventional rod mill note how rods are spaced farther apart at feed end, resulting in series of long wedge-shaped slots. Fig. 2: In peripheral discharge mill, rods maintain parallelism as shown here

effort to reduce the fines by increasing the space between the rods.

As a result of tests, it became apparent that the rods were spaced farther apart at the feed end of the mill than at the discharge end, due to the size of feed entering the mill. It further became apparent that this resulted in a series of long wedge-shaped slots tapering from the feed end, as shown in Fig. 1. In operation these slots exist throughout the rod mass and act as a screen to the material entrapped within the rod charge and allow only the finer particles to pass through and work to the discharge opening. The coarser particles are retained within the rod mass by these narrow slots and are further reduced. This screening action accounts for the uniformity and lack of oversize in a rod mill product.

From the results of the grinding tests, particularly those which followed "spooling" the rods, it was apparent that less fines should be produced if the rods could be held apart at both ends of the mill. Accordingly, the mill was rebuilt so that feed entered at both ends and discharged at the center through a peripheral ring having ports equally spaced around the mill circumference. The rods, of course, extended the complete length of the mill. This mill gave much better results than the standard mill and was adopted for dry grinding practice where a minimum of fines was required.

A rod mill may be defined as a rotating cylindrical shell with wear-resistant removable liners and carrying a charge of rods that reduces mill feed by abrasion and impact as the rods cascade within the shell. A rod mill differs from a ball mill in that the comparatively rigid grinding media operate in a relatively fixed path and reduction results from line rather than point contact between grinding surfaces. Conventional rod

mills are of either high or low discharge type. In the high discharge mill the discharge trunnion is the same size or only slightly larger than the feed trunnion and in wet grinding a deep pool of pulp always is present within the grinding chamber. In the open end, or low discharge type, the pulp pool is quite shallow due to the large trunnion opening on the discharge end. In either type the rods are roughly parallel but are farther apart at the feed end. These were the two kinds of mills which had been used for sand grinding up to the end of the war.

When the demand increased for manufactured sand, the rod mill was given considerable attention as a means of producing sand. Based on the results attained in dry grinding, it seemed quite possible that the center discharge type of mill could be adapted to wet grinding for sand production with the advantage of producing a minimum of wasteful slimes. There was some doubt as to the successful use of this type of mill due to the fact that efficient rod milling depends to some extent on coating the rods with pulp and it was thought that possibly the deslimed granular feed would ride the top of the rods while the water would simply pass through and out of the mill. Such action would, in effect, be the equivalent of dry grinding. However, when one of the dry grinding center peripheral discharge mills became available at a relatively low price, the first installation was made at a sand and gravel plant in California and proved to be highly successful. Operation of the mill was described in some detail in the October, 1947, issue of *ROCK PRODUCTS*. This installation proved that the center discharge mill was an economical and efficient unit for sand production. Some changes in design were indicated as desirable since the operating characteristics of such a

mill were somewhat different from a standard rod mill. Since the mill is fed at both ends and since optimum operation requires a steady feed, scoop or drum feeders were not considered satisfactory. Either of these types of feeders results in feed spurts and there is considerable wear. Also, in order to get into the mill for inspection or to charge rods, it was necessary to remove the entire feeder on one end. To remedy this situation the spout method of feeding was adopted and has been very successful. Since the rods in this type of mill are actually parallel, as shown in Fig. II, there is no tendency for the rods to come out either trunnion.

Time of residence of pulp within a center discharge mill is only half that for a conventional mill and therefore water must be controlled closely. It has been found preferable to feed these mills with a relatively dry deslimed feed and add water to the spout feeders just before the material enters the mill. Any change in density immediately reflects in the discharge product and it is therefore important that the operator have immediate and complete control of the water. In general, best results are obtained when operating at approximately 60 to 65 percent solids or with a discharge pulp having the consistency of a thin batter.

The various cost factors of operation include rod and liner wear, power, labor, lubrication and such miscellaneous items as the charging of rods and relining.

These factors, especially power costs, vary slightly depending upon the locality but are fairly uniform. Labor rates throughout the country are standardized generally and since liners and rods are available from points close to most installations, the difference in freight rates makes very little difference in the overall cost.

Average rod wear in a sand grind-

## GRINDING

ing center discharge mill varies from about 0.5 to 1.0 lb. per ton of feed, depending on the rock hardness and the mill operating characteristics. When a mill is underloaded, rod wear increases rapidly. In a conventional mill rods wear more at the feed end, whereas in a peripheral discharge mill, rods tend to wear uniformly at both ends. Rods may be either high carbon or alloy, but in either case should be machine-straightened.

Liners usually are of manganese steel, having about 12 to 14 percent manganese, or of rolled plate steel, held in place by alloy steel clamp lift bars. Average liner wear is from 0.08 to 0.10 lb. per ton of feed.

Generally the initial rod charge to a mill should consist of 2-in., 2½-in. and 3-in. rods in such proportion that the total surface areas of each size are closely the same. Rod additions made thereafter are usually all 2 in. The charging of rods should be done periodically once or twice a week and requires not more than 30 minutes. As the rods wear and become small they tend to flatten into an oval shape and eventually break up into small pieces which are discharged from the mill. Some operators prefer to remove these rods before they break up; this is often done when the mill is shut down for the addition of extra rods.

The following table gives average costs:

	Cost Per Ton
Rods @ \$6.00/cwt. delivered	\$0.050
Power @ 1c/KW	0.026
Liners @ \$17.00/cwt. delivered	0.017
Labor @ \$1.50/hr.	0.025
Miscellaneous	0.010
Total	\$0.128

When a pump, classifier and necessary conveyor belts are considered as part of the sand plant proper, the average cost approximates 15c per ton.

There are a number of features which are desirable in any plant designed for manufacturing sand and the equipment used therein should embody certain essential characteristics. Seven considerations are desired by most operators and each of these is discussed in some detail.

1. **Gradation flexibility** may be defined as the ability of a given plant to meet variable specifications from the same rock or meet set specifications from rocks of different characteristics. In the former case an example is a large dam in the East. The original plant was designed to produce 100 t.p.h. sand having a fineness modulus of 2.78. After the plant began operations it was found that some grinding was taking place in the cement mixers, so the fineness modulus was raised to 3.30. This was easily met with only very minor adjustments. Feed rate was held constant. Later developments in the quarry resulted in obtaining harder granite, but the plant was

adjusted to this new condition with minor changes and no drop in production. In the latter case, rock characteristics such as hardness, or critical grain size, might change and the plant must be capable of adjustment to meet these changes. A plant handling rock from first one quarry and then a different rock from another quarry would be an example.

2. **Particle shape** is given a great deal of weight by both the Corps of Engineers and the Bureau of Reclamation. The most desirable shape is cubical and this is obtainable in a rod mill. At one large dam the crusher fines originally bypassed the rod mill. When these were also included with the mill feed a definite improvement resulted in particle shape due to rod action knocking off the rough corners made in crushing. Even very slabby material produces cubical sand when ground in a rod mill.

3. **Continuity of operation** is extremely important to a contractor who has to maintain a pouring schedule. Any delays result in expensive idleness of men and equipment so bottlenecks must be prevented. Since rod mills were designed for 24-hr. operation in ore milling, they naturally have no difficulty in operating the normal 8-hr. day usually required in sand production. They do not require the frequent and numerous repaires that impactors, hammermills and rolls need. Wet or sticky material can be handled easily.

4. **Cost of operation** is not as important to the contractor on a government job as it is to the sand and gravel operator, but in either case it is a consideration. Even a cent a ton is a considerable amount on 300,000 tons of sand. Rod mills operate very economically. The rods, which account for most of the metal wear, are far cheaper than roll shells, cone crusher mantles or hammers. Overall costs, exclusive of amortization, but including rod and liner wear, power, labor, maintenance and lubrication, should not average more than \$0.12 to \$0.15 per ton ground.

5. **Initial installation cost** is a very important matter to the average sand plant operator and therefore many small operators cannot afford a rod mill-classifier plant. Such an installation costs more than rolls or the impactor - hammermill - rolls combination, but it will result in substantial savings in operating cost.

6. **Salvage value of equipment** should not greatly concern operators who have a permanent plant. The government contractors usually plan on writing off their investment during the life of the job and, since most dams require from three to five years to build, daily or tonnage amortization charges are quite reasonable. Present construction of rod mills for sand and gravel greatly increases the salvage value. These mills are built so that they may be operated either as center or end peripheral discharge mills. By removing the peripheral ring, adding a door plug to the discharge end and installing a smaller diameter trunnion liner in the feed end, the mill reverts to an open end rod mill which has resale possibilities in the mining industry.

7. **Dust** is an ever-present nuisance at most sand plants and, in many states, must be controlled. In the wet grinding rod mill-classifier plant, the dust hazard is entirely eliminated without the need for expensive collecting equipment.

## Mineral Group Meets

AT THE 1949 FALL MEETING of the Oklahoma Industrial and Mineral Industries Conference, the group voted to continue the organization as the Oklahoma Industrial Development Conference. The new name was adopted for the combined groups of the Oklahoma Mineral Industries Conference and the Oklahoma Industrial Conference. Central office will be established at the Bureau of Business Research, University of Oklahoma, Norman. Since the conference was organized in 1940, industrial employment in the state has increased 79 percent. The conference members voted to declare the organization a permanent one to meet once annually during September, October or November.

## Montana Corundum Deposit

COMMON CORUNDUM, suitable for abrasive use, occurs in several thin-lenticular beds or veins in metamorphic rocks of pre-Cambrian age in Gallatin and Madison counties, southwest of Bozeman, Mont. These deposits were investigated by S. E. Clabaugh of the U. S. Bureau of Mines and the Geological Survey as potential sources of abrasive materials. The report "Corundum Deposits of Montana," accompanied by large-scale maps of the Yogo sapphire deposit and the abrasive corundum deposits has been approved for release and will be placed in open file for public inspection in the General Services Building, Washington, D. C.

## Design of Concrete Mixes

By C. J. KNICKERBOCKER

PRESENTED HERE is a method for the design of concrete mixes. Use Chart No. 1 to determine water-cement ratio in terms of gallons per bag. Use Chart No. 2 to determine total water requirement per cu. yd. Determine cement and mixed aggregate requirement from Chart No. 1; percent sand from Chart No. 3. Correct water and aggregates for free moisture in aggregates. Should more or less water than assumed be used, make the correction as follows:

From intersection of curves of actual total water content and desired w/c ratio, locate new cement and aggregate weights. By maintaining a constant total water content, the cement and aggregate proportions may be interchanged with no appreciable change in consistency (slump).

Example solution:

3500 p.s.i. concrete  
1-in. crushed rock

3-in.-4-in. slump

Chart No. 1 6 1/2-gal. water per bag  
Chart No. 2 40-gal. water per cu. yd.  
Chart No. 1 6.15 bags cement  
Chart No. 1 3900-lb. mixer aggregate  
Chart No. 3 43-percent sand

Increase aggregate weight and decrease added water weight in order of weight of free moisture in aggregate.

Example solution:

Design above for use of Type Ia cement and air entrainment of 5 percent.

Deduct Chart No. 4 value of 3 gal. or 25 lb. of water from Chart No. 5 value of 175 lb.

Reduce added water by 3 gal. and reduce sand by 150 lb.

This concrete will develop about 85 percent of the strength of normal concrete in the first example. Air entrainment may be checked by unit weights and use of Chart No. 8.

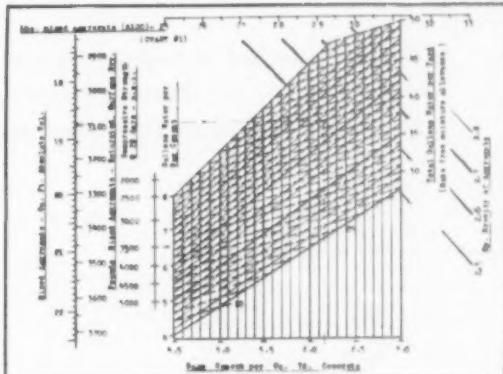
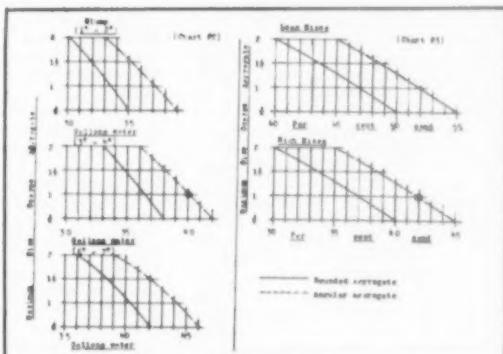
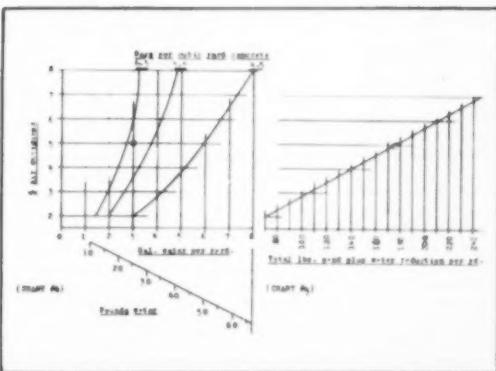


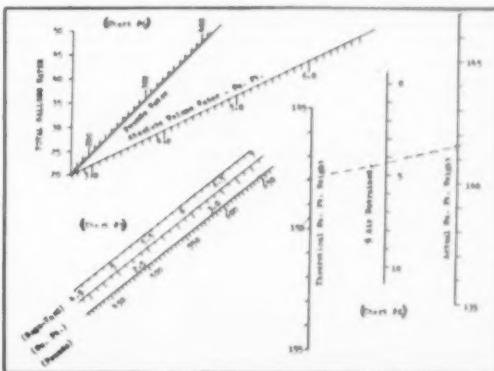
Chart No. 1 for determining water-cement ratio, cement and mixed aggregate requirement



Charts Nos. 2 and 3 for determining total water requirement and sand proportion (approximations)



Charts Nos. 4 and 5 (left) allow an estimation being made of the required reduction of water and sand for different cement factor mixes to compensate for air entrainment. Charts Nos. 6, 7 and 8 (right), air entrainment may be checked unit weights and use of Chart No. 8.



## Pozzolans in Concrete Pavements

This is the second of two articles describing concrete test pavements under construction by the Kansas Highway Commission. The first article, in the January issue, compared modern cements with "old-fashioned" cements

KANSAS, like many other states and public agencies, has been troubled with expansive concrete—particularly in its pavements. The particular "growing pains" dealt with in this article are similar to the reaction between high alkali cements and certain aggregates such as has been described by Stanton in the A.C.I. *Journal*, January, 1942, and Tremper, A.C.I. *Journal*, November, 1944. However, it has not been possible through laboratory research to ascribe these expansive characteristics of concrete to this one particular phenomenon.

Expansive characteristics of cements in Kansas have been ascribed thoroughly by Scholer and Gibson (A.C.I. *Journal*, December, 1948) to a reaction between the cement and aggregates which causes an expansion even though the cement is low in alkali. This deterioration manifests itself in a type of distress now known as "map cracking." It is so called because the first visible evidence, usually appearing in about five years, consists of a series of connected cracks on the surface of the pavement. This cracking at first is evident only when the concrete is moistened and allowed to dry partially. The small cracks retaining the most moisture clearly reveal the crack pattern and resemble a boundary map. This deterioration progresses with age, evidenced by the cracks deepening and the segments becoming smaller and smaller as the cracks form. Later these segments loosen and "shell out" from the surface of the concrete. There is a definite loss in flexural strength proportionate to the progression of cracking. The expansion joints close to the point at which they are practically useless for absorbing changes in the length of the pavement. Apparently there is a certain amount of compressibility in this type of concrete since joint "blow ups" are very rare.

The aggregate most susceptible in this expansive reaction in this area has been given a name suited to its gradation, namely "sand-gravel." This grading must be used in the western two-thirds of Kansas, most of Nebraska, and parts of Iowa for economic

By W. J. ARNDT\*

reasons since coarse aggregates are not available. It is possible to grade these sand-gravel aggregates to permit them to be used as a total aggregate in the manufacture of concrete. In this area, these aggregates are entirely siliceous with a very small quantity of coarse fractions. Usually this is from 1 percent to 15 percent, by weight, of the fraction retained on the No. 4 sieve. The maximum size is usually  $\frac{3}{8}$  in. In view of the fact that most of these aggregates have exhibited expansive reactions, a solution must be found wherein "map cracking" is reduced to a negligible factor in concrete deterioration.

As stated earlier, map cracking, though related to the cement-alkali-aggregate reaction, is not necessarily confined to a combination of those aggregates and cements high in alkali. The reaction as found by Scholer and Gibson apparently is a physical-chemical reaction since the curatives found have been identified with both of these property characteristics. This deterioration has reached such magnitude in some bridges that a complete reconstruction job has been necessary in order to save the structure. Pavements have suffered even to a greater extent since the slabs all are thin sections (usually 9-7-9) and traffic vibrations accelerate the destruction of such roads. Many miles of pavement have required premature resurfacing. Many more miles have not provided the service life expected of them and have been a constant source of irritation to motorists as well as the maintenance crew.

Recognizing the inherent economy in the use of these sand-gravel aggregates, the Portland Cement Association and the Engineering Experiment Station of Kansas State College initiated a comprehensive research program in 1942 pointed toward improving the durability of this type of concrete. This work was concluded in 1945 with the following recommended curative measures (the following quantities of coarse fractions recommended to be added to the typical

sand-gravel were found to be adequate for reducing expansive reaction of the aggregates, when made into concrete, to a negligible value which was described as 0.07 percent in one year):

1. Use of approximately 30 percent of crushed limestone with a maximum size of 1 in. and which is 95 percent retained on the No. 4 sieve.

2. Use of approximately 25 percent of crushed cherts, a sound chert resulting from the mining of zinc and lead.

3. Use of 40 percent of crushed quartzite graded similarly to the limestone in recommendation No. 1.

These curative measures were adopted by the Kansas Highway Commission in 1945, and at present exist as the best known means of correcting this destructive occurrence. In the report containing these recommendations the following further study was recommended:

"The addition of artificial pozzolanic material. An addition of 20 percent by weight of the cement of such a material has greatly reduced the expansion of concrete made with highly expansive aggregates."

Further laboratory work at Kansas State College under the direction of Professor C. H. Scholer strengthened the indications that pozzolanic additions were effective in holding the expansion to a negligible amount as well as imparting other desirable properties to the concrete. Experience with pozzolans by the Bureau of Reclamation was studied also and again pointed to improved concrete through the use of pozzolans. The addition of coarse aggregates to these sand-gravels recommended by the 1945 report, while apparently effective, results in an economic burden since in many instances the coarse additions must be shipped two or three hundred miles. Thus it became desirable for economic reasons to determine if the addition of pozzolans as a cement replacement would yield equally desirable results as the coarse aggregate additives. Pozzolans are available locally in the areas where the sand-gravel aggregates occur so that, if this solution is sound, a considerable saving in concrete costs would result. (For the test project which is herein described,

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## TESTING

proved pozzolanic additions were shipped long distances but only to explore the possibilities of this type of material. These additions undoubtedly can be produced locally if they prove effective.

From the January-February issue of the A.C.I. *Journal* comes the following definition of a pozzolan:

"A pozzolan is defined as a siliceous material that in the presence of moisture will combine with lime to form a reasonable strength producing compound. During the hydration of portland cement, lime is liberated. During the hydration of portland-pozzolan cement, the lime liberated by the portland cement constituent is considered to combine with the pozzolan."

This same issue expresses the following benefits to be derived from the use of portland-pozzolan cements: (1) improved workability, (2) freedom from segregation and water gain, (3) high factor impermeability as compared with low heat portland cement, (4) in comparisons with modified portland cement a greater percentage of total heat of hydration is developed at early ages and less total heat of hydration, (5) relative high early tensile and compressive strength compared with high early and high plastic properties, and (6) long continued gain in strength.

If found to be true, such beneficial results would gladly be accepted by most engineers throughout the country and especially by the engineers in Kansas. With this background, it was decided early in 1949 to construct a field test concrete pavement project in which various pozzolanic additions would replace portions of the cement.

A city by-pass on U.S. 81 around McPherson, Kan., was chosen as the site. The traffic count there was 2725 passenger cars and 1115 trucks daily. Most of the trucks are loaded gasoline transports. The project is 5.2 miles long and appropriately located since it is in the heart of the sand-gravel area. The specified sand-gravel was required to be produced from the Republican river since this source has been known by experience to produce the most expansive of the sand-gravels. Actual service records of material from that source were extremely poor and laboratory research has verified the fact that these aggregates had an expansive reaction. It was reasoned that if pozzolanic additions proved to be effective in reducing the expansion of the aggregates from this source, then they would undoubtedly prove an effective remedy for all such aggregates in Kansas, as well as in other areas with similar materials. The other advantages of pozzolans will be watched carefully for additional gains over those which are the immediate aims.

The project as contracted for to J. W. Watson, contractor, Topeka, Kan., for \$406,700, consists of 60 sections, each 500 ft. long. This layout

was conceived after much study by the engineers of the Kansas Highway Commission, the Bureau of Public Roads and the Portland Cement Association. The following major variables were included in the 60 sections as planned: (a) cement from four sources, (b) pozzolans from 3 sources, (c) the addition of crushed limestone to sand-gravel not containing pozzolanic additions, (d) air-entraining and non-air-entraining cement for each of the above variations, and (e) blanks consisting of only sand-gravel with and without air-entraining cement.

### Cements

It was decided to use four different cements produced in the area, two of which were more reactive with the sand-gravel than were the other two. The cements were specified as Ash Grove brand cement from Louisville, Neb., Lehigh cement from Iola, Kan., Lone Star cement from Bonner Springs, Kan., and Ideal cement from Superior, Neb. The order in which these cements are listed here is not significant as to the reactivity with the chosen aggregate. All cements were normal portland cement complying in all respects to the requirements for Type I cement (A.S.T.M. designation C-7).

### Pozzolans

Three pozzolans were required for this project. Each pozzolan had previously been shown by extensive laboratory data to be effective as pozzolana and further to be effective as additions with these cements in reducing the expansive characteristics of concrete made with this sand-gravel. The specified pozzolanic materials were: ground, calcined Monterey shale from California; ground, calcined Mowry shale from Wyoming; and fly ash from Chicago. Although most engineers have heard of pozzolans, it is assumed that not many are familiar with their manufacture or their characteristics. Therefore, since doubtlessly much will be written and heard about such materials in the future, considerable space will be devoted in giving a description of these pozzolans and their manufacture as described to us by the producing companies. (The fall meeting of A.S.T.M. in San Francisco had a symposium on pozzolans in general, and was reported in the December, 1949, issue of *Rock Products*).

**Monterey shale**—The calcined and ground Monterey shale which serves as a pozzolanic admixture is produced by the California Portland Cement Co. at Colton, Calif. This plant has been producing the material for the Bureau of Reclamation for several years. It has been used in such structures as the Davis dam project in Arizona-Nevada. The raw Monterey

shale is obtained from a company-owned deposit located about three miles northwest of Pomona, Calif. Care is taken to select shale with the highest degree of pozzolanic activity. When shipped to the plant, the raw shale contains about 30 percent water. A typical analysis of this raw shale is:

	Percent
SiO <sub>2</sub>	42.0
Al <sub>2</sub> O <sub>3</sub>	9.0
Fe <sub>2</sub> O <sub>3</sub>	3.7
CaO	5.7
MgO	2.0
Na <sub>2</sub> O	0.7
K <sub>2</sub> O	1.2
Loss on ignition	3.7

The raw shale is mildly calcined at 1400 deg. to 1600 deg. F. in a conventional rotary kiln. The material fed to the kiln is 2 in. or less in size. Care is taken to maintain an oxidizing atmosphere in the kiln. The calcined shale is kept in covered storage until ready for grinding, which is performed in a conventional closed-circuit tube mill. The finished pozzolan has the following analysis:

	Percent
SiO <sub>2</sub>	61.60
Al <sub>2</sub> O <sub>3</sub>	13.94
Fe <sub>2</sub> O <sub>3</sub>	5.26
CaO	4.97
MgO	2.84
Na <sub>2</sub> O	1.16
K <sub>2</sub> O	1.68
Loss on ignition	5.31
Passing the 225-mesh sieve	97.00
Specific surface (Blaine) 12,000 to 13,000 sq cm. per gram.	

The ground Monterey shale is pinkish-tan in color and imparts a similar hue to the concrete into which it is incorporated. In order to ascertain whether or not such shales possess adequate pozzolanic activity, the calcined and ground additive must meet the following requirements:

Reactivity with hydrated lime; compressive strength in 7 days not less than 600 p.s.i.

Reactivity with sodium hydroxide; reduction of alkalinity of solution not less than 40 percent.

(Details of these test methods may be obtained from the U. S. Bureau of Reclamation, Denver, Colo., in Specification 1904).

**Fly ash**—The fly ash for this project was obtained from the Combustion By-Products Co., Chicago, Ill. This particular fly ash is being furnished to the Bureau of Reclamation for Hungry Horse dam in Montana. One should not assume that all fly ash possesses pozzolanic activity. In fact, much of it does not, but when properly collected most of it could be used as a pozzolan.

The Combustion By-Products Co. collects fly ash in electric precipitators just before the flue gas from burning pulverized coal enters the stacks. Most of the particles of fly ash are spherical in shape and possess a smooth glassy surface as a result of being fused at a temperature far above their melting point. The following analysis is typical of the fly ash used in the McPherson project:

## TESTING

	Percent
$\text{SiO}_2$	43-47
$\text{Al}_2\text{O}_3$	16-24
$\text{Fe}_2\text{O}_3$ and $\text{FeO}_3$	12.19
$\text{CaO}$	1-8
$\text{MgO}$	1-2
$\text{Na}_2\text{O} + \text{K}_2\text{O}$	4-6
$\text{SO}_3$	2-3
Free Carbon	1-2
Moisture	0.5
Loss on ignition	1.3
Expansion with water	Alkaline
Passing No. 325-mesh sieve	95-95
Specific Surface (Blaine) 3600 sq. cm. per gram.	

The pozzolanic activity is measured by the following requirements: activity shall be determined from the compressive strength of 2 x 4-in. cylinders prepared by mixing two parts fly ash, one part hydrated lime (high calcium), nine parts standard Ottawa sand and sufficient water for a workable mix. The test specimen shall be cured in a sealed container at 70 deg. F. for 12 hr., 100 deg. F. for 12 hr. and 130 deg. F. until seven days have elapsed, at which time the cylinder shall have a compressive strength of not less than 600 p.s.i.

**Mowry shale**—Mowry shale is produced by the Monolith Portland Midwest Co., Denver, Colo., at Laramie, Wyo. The shale is crushed and then calcined in an oil-fired rotary kiln at temperatures between 1600 deg. F. and 1800 deg. F. Since this company was not in a position to grind the calcined shale, it was shipped to the Monarch Cement Co. plant at Humboldt, Kan., to be ground for this project. The clinker was ground to a specific surface of between 8000 and 10,000 sq. cm. per gram, sacked and then shipped to the project. This pozzolanic material is dark gray in color.

### Crushed Limestone

Gibson and Scholer found the addition of about 20 percent crushed limestone to be effective in reducing the expansive properties of sand-gravel concrete. Therefore, in order to have a measure for comparison placed under the same conditions as the pozzolanic additions, there was placed at least one section with each cement containing 30 percent crushed limestone as an additive to the sand-gravel. The crushed stone for this project was produced by the Moline, Kan., plant of the Concrete Materials and Construction Co., Cedar Rapids, Iowa. The gradation of the stone was:

Screen (Sq. Mesh)	Percent retained
1 1/2 in.	0
1 in.	6
5/8 in.	38
5/16 in.	85
8	98
16	99
32	99
50	100
100	100
200	100
Wash	1.3

### Sand-Gravel

The sand-gravel used in this project was graded for use as a concrete aggregate by itself, even though the

maximum size was small. Such an aggregate type without its expansive properties is an essential part of the thinking of Kansas engineers as well as other engineers in this area. The reasons for this are economic and have been described previously in this article. The Republican river flowing through Kansas and Nebraska contains the worst reactive offenders and therefore this source was specified for the project. Each of the 60 sections on this project contains this aggregate as the basic material. The basic aggregate was produced at Wakefield, Kan., from the Republican river by the Wakefield Sand-Gravel Co. A typical grading of this sand-gravel aggregate is:

(Sq. Mesh)	Percent retained
Sieve	
5/8 in.	0
1/2 in.	3
5/8 in.	8
8	23
16	45
30	70
50	91
100	99
Fineness Modulus	3.39
Wash	0.5

Laboratory tests had revealed this aggregate, when untreated, to be quite actively expansive with cement in concrete. The expansion with some cements was worse than with others. Structures and pavements constructed with this aggregate were badly cracked after seven years, and by ten years were in many instances in need of major repair or replacement.

### Air Entrainment

Since some pozzolans on occasion have revealed an inability to withstand freezing and thawing, it was deemed desirable to add an air-entraining agent to some of the sections on this project. It was thought necessary to determine what beneficial effect air entrainment might prove to have. The air-entraining agent was specified to be added at the mixer. Only neutralized Vinsol resin was permitted. The material for this project was Protex AEA manufactured by the Autolene Lubricants Co., Denver, Colo.

Round No.	Brand of Cement	Aggregate Type	Admixture	Air Entrainment
I	Lone Star	Sand - Gravel	None	No
1 (Sec. 1 thru 8)	Lone Star	Sand - Gravel	None	Yes
2	Lone Star	Sand - Gravel	Mowry shale	Yes
3	Lone Star	Sand - Gravel	None	Yes
4	Lone Star	Sweetened sgr.	Fly ash	No
5	Lone Star	Sand - Gravel	Fly ash	Yes
6	Lone Star	Sand - Gravel	Fly ash	Yes
7	Lone Star	Sand - Gravel	Monterey shale	No
8	Lone Star	Sand - Gravel	Monterey shale	Yes
II	Lone Star	Sand - Gravel	Mowry shale	No
9 (Sec. 9 thru 14)	Lone Star	Sand - Gravel	Mowry shale	Yes
10	Lone Star	Sand - Gravel	None	No
11	Lone Star	Sweetened sgr.	None	Yes
12	Lone Star	Sweetened sgr.	Fly ash	Yes
13	Lone Star	Sand - Gravel	Mowry shale	Yes
14	Lone Star	Sand - Gravel	Mowry shale	Yes

Sections 15 through 28—These rounds are a repetition using Lehigh portland cement instead of Lone Star portland cement.

Sections 29 through 42—These two rounds use Ideal portland cement.

Sections 43 through 56—These two rounds use Ash Grove portland cement.

Sections 57 through 60—These four sections were intended to use sand-gravel aggregate with a new cement now in production by the A. G. Groves Portland Cement Co., Louisville, Neb., called PPFZ. This cement would contain the pozzolanic admixture interground with the cement. Since the cement was not yet ready for marketing, these four sections were replaced with Ash Grove cement from the company's plant at Chanute, Kan. Two sections were with the basic sand-gravel and without air entrainment and the other two were "sweetened" with crushed limestone with and without air entrainment.

### The Project

The McPherson, Kan., project was put under construction in the latter part of 1949. Many interesting facts and construction features have already been revealed. These details will be published when they have obtained sufficient significance to be noteworthy.

The layout of the project is of considerable interest for a study of the variables in the many sections. It seems clear that such coverage can produce valuable data. Each section is 500 ft. long and contains identical structural features. A 4-in. granular subbase underlies the entire pavement. The various sections and the material constituting the concrete are as shown below.

Each pozzolanic addition replaced from 20-27 percent by weight of the cement. Each pozzolan was received packaged so that full batches could be produced in the Koehring 34-E mixer traveling outside the forms. The air-entraining agent was added by an automatic dispenser mounted on the mixer.

In view of the fact that the Kansas Highway Commission has a second test road under study simultaneously with the McPherson project, the interest is especially high. This second project was described in the January, 1950, issue of *ROCK PRODUCTS*. This second project is known as the Topeka project and consists of eight miles of concrete pavement in which "old fashioned" cements similar to cements produced in the 1920's are being compared to present day cements.

Section markers describing the characteristics of each section of both projects will be placed along the right-of-way lines so that anyone interested can view these pavements with proper identification.

The headquarters office of the Kansas Highway Commission is in the Masonic Temple Bldg., Topeka, Kan., and anyone wishing to inquire or visit these projects would gladly be received.

# Constitution of Cement Clinker Obtained By Basset Process

Microscopic research indicates that portland cement clinker from this process has many characteristics of commercial clinkers

THE AUTHOR published four research reports in the German cement journal *Zement* on this subject<sup>1</sup> from 1937 to 1939. The present report, which is a continuation of the preceding ones, was completed some years ago but had no chance of being published because international correspondence had been suspended for a long time since outbreak of the war.

This is the second article by Dr. Koyanagi to appear in *ROCK PRODUCTS*, on the constitution of cement clinker by the Basset process. The first is found in the May, 1949, issue, page 60. A third article will appear in the near future.

The manufacture of pig iron and cement clinker simultaneously by the Basset process was first done by the Spanish portland cement company, "Asland," from 1931 to 1935. The process was introduced in Japan during the war by three cement plants on a far larger scale than in Spain, and both pig iron and cement of fairly good quality have been produced in large quantity.

As the author directed the process in one of the plants, the manufactured products were tested in his laboratory. In examination of the clinker under

By K. KOYANAGI<sup>2</sup> and  
T. SUDOH

the microscope, a remarkable fact was observed in that the principal clinker minerals—alite, tricalcium aluminate and dicalcium silicate—were clearly defined and of greater size than ever before observed. The clinker, though it contains some metallic iron and is a little high in alumina, does not differ much from ordinary portland cement in composition. It definitely belongs to the portland cement type. The author expected that the minute examination of this clinker would make some contribution to the solution of alite and C<sub>3</sub>A problems which have not yet been clearly solved.

## Microscopic Examination

The chemical composition of clinker made by the Basset process is influenced by the iron ore used as raw material and the state of reduction that occurs in the kiln. There always is metallic iron present in the form of globules. The clinker used in the observations discussed here was one

obtained by using pyrite cinder as raw material and containing a comparatively small amount of metallic iron, its section being greyish white in color. The clinker, when ground in a test mill and after separating out iron globules with a magnetic separator, gave the following chemical composition:

SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe	CaO	MgO	S	Free CaO	trace
21.81	8.46	1.58	65.60	1.85	0.70		

Specific gravity 3.16

The cement made out of this clinker had a tensile strength of 35 kg./cm.<sup>2</sup>, compressive strength of 438 kg./cm.<sup>2</sup> after 28 days and was completely sound either in the water or boiling test. The cement had a 2 percent residue on a sieve with 4900 meshes per square centimeter.

For the microscopic examination two methods were employed: (1) the examination of thin sections by transmitted light, and (2) of polished and etched surfaces by reflected light. The latter method which is systematized by Tavasci<sup>3</sup> proved itself very effective in the examination. As etching material, one percent nitric acid in absolute alcohol was used.

The most remarkable observation in the clinker under the microscope was that quite a great number of well-formed square crystals of tricalcium aluminate were clearly recognized by their shape (Fig. 1 and Fig. 2). When a thin section was observed in transmitted light, using Nicols, these crystals proved themselves to be isotropic (Fig. 3).

It is generally considered to be very difficult to find the crystal of tricalcium aluminate in commercial portland cement clinker by optical means. This is due to the similarity in refractive index between this compound and tricalcium silicate, especially when the presence of iron-containing systems raises the index of C<sub>3</sub>A. H. Insley and H. F. McMurdie<sup>4</sup> found the crystal of C<sub>3</sub>A as the interstitial material in some commercial clinkers.

Alite appeared in this clinker in



Fig. 1: Photomicrograph of polished and etched section of the clinker. Note well-formed crystal of alite (A), square crystal of tricalcium aluminate (B). 100 magnifications

<sup>1</sup>Japan Cement Engineering Association  
T. Sudoh, who took part in the X-ray research, died some time ago in Siberia as a war prisoner

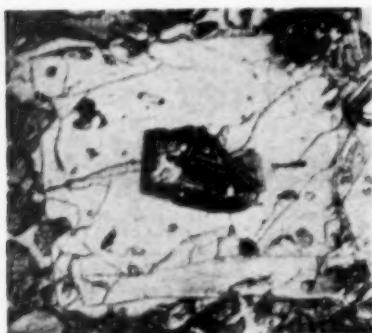


Fig. 2: Photomicrograph of polished and etched section. Note crystal bud of alite in center of C.A. 100 magnifications

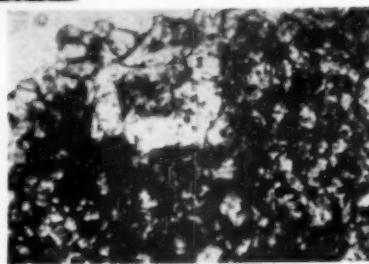


Fig. 3: Photomicrograph of thin section in transmitted light (Nicol), 100 magnifications

the form of well-formed hexagonal crystals in nearly the same large size as C<sub>3</sub>A (Fig. 1). When the polished surface of the clinker was etched with one percent nitric acid and observed under reflected light, the hexagonal crystals of alite showed a beautiful zoned structure, which is greatly influenced by the direction of the main axis; they appear far clearer on the surface perpendicular to the axis than on the parallel surface. The crystals show a weak birefringence when observed under transmitted light.

The zoned structure of alite, as pointed out by H. Insley, E. P. Flint, E. S. Newman and Swenson<sup>4</sup>, shows the existence of partial non-uniformity in composition in the crystal which is due to the sudden cooling of a solid solution. In observing the photomicrograph more minutely, it can be seen that alite forms with the square crystal of C<sub>3</sub>A (Fig. 1), and alite appears in the center of C<sub>3</sub>A as a crystal bud (Fig. 2). These phenomena show the possibility of formation of a solid solution between these two compounds, and also that alite can grow from C<sub>3</sub>A as the mother substance.

The results of this examination show good coincidence with those of X-ray investigation by the author in the preceding report<sup>5</sup>, in which X-ray diffraction patterns of the clinker part very rich in C<sub>3</sub>S (80 percent C<sub>3</sub>S) as separated by centrifugal treatment from a commercial high early strength portland cement clinker were compared with those of pure C<sub>3</sub>S. It was found, as Insley<sup>6</sup> also noted, that there was a slight shift in the position of the X-ray diffraction patterns between

them. This shift decreases with increasing amount of C<sub>3</sub>A in C<sub>3</sub>S melts, and when C<sub>3</sub>S takes a certain quantity of C<sub>3</sub>A and a small quantity of MgO (perhaps one to two percent) into it, the shift in position completely disappears, showing good coincidence.

Dicalcium silicate appears in this clinker as relatively large grains of rounded outline, striated by fine polycrystalline twinning bands. (Fig. 4) Some grains have interpenetrating striations, others parallel ones. Besides, it was often observed as a dark band in the crystal of alite (Fig. 5).

The band in the alite crystal consists of fine crystal grains, showing higher birefringence, which is the sign of C<sub>3</sub>S. H. Insley<sup>6</sup> designated the

first one Type I, the second one Type II, and the last one Type III. He believed all are in  $\beta$ -state of dicalcium silicate. Sandius<sup>7</sup> noted the first one is in  $\alpha$ -state and the second one in  $\beta$ -state.

In addition to the above mentioned principal minerals, numerous crystal particles colored in yellowish white were often found scattered in alite, C<sub>3</sub>A, and the glass part of the clinker. These crystals were first thought to be free CaO, but as the clinker contains no free CaO, (moreover the crystals were easily corroded by hydrofluoric acid) they disappear in a few hours when the clinker specimens are left in contact with moist air, and then a smell of hydrogen sulfide occurs. From this, the crystals were determined to consist of calcium sulfide.

The clinker contains, as analysis shows, some metallic iron in the form of globules. Its photomicrograph is shown in Fig. 6. A characteristic cementite crystal in net form is to be seen in the figure, showing that the iron globule in clinker is composed of steel.

The results of the microscopic examinations were further confirmed by the following X-ray investigations.

#### X-ray Examination

The clinker samples for the X-ray examination were prepared by separating the clinker powder in 20 fractions by means of a centrifugal machine operating at 3000 r.p.m., using as suspension liquid the mixtures of methylene iodide and acetylene tetrabromide of various specific gravities. As the clinker contains a certain quantity of substance much lighter than the constituents of ordinary portland cement, a liquid lower in specific gravity, i.e., ethylene iodide (sp. gr. 2.18) must sometimes be added to the above mixture. The results of the centrifugal separation and chemical composition of separated clinker fractions are given in Table 1.

(Continued on page 132)

No. of Fraction	Range of Specific Gravity	Chemical Analysis (Percent)							Percent of Fraction
		SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe	CaO	MgO	S	Total	
1	2.68-2.74	10.75	7.65	0.79	61.08	1.36	18.37	100.00	5.5
2	2.74-2.80	13.56	11.80	0.73	61.70	2.21	10.00	100.00	2.0
3	2.80-2.86	14.97	12.65	0.98	61.77	2.31	7.32	100.00	4.0
4	2.86-2.92	14.58	14.35	1.02	62.81	2.53	4.71	100.00	4.5
5	2.92-2.96	17.14	14.01	0.69	61.66	2.62	3.88	100.00	4.0
6	2.96-3.00	18.95	11.90	0.64	62.92	2.45	3.14	100.00	4.0
7	3.00-3.02	19.14	11.11	0.67	63.24	2.66	3.18	100.00	2.0
8	3.02-3.04	19.09	11.36	0.74	63.38	2.70	2.73	100.00	3.0
9	3.04-3.06	20.56	11.94	0.59	62.91	2.51	2.49	100.00	2.0
10	3.06-3.08	21.21	9.25	0.67	64.80	2.43	1.64	100.00	1.5
11	3.08-3.10	21.58	8.60	0.56	65.60	2.44	1.22	100.00	6.0
12	3.10-3.12	21.71	8.94	0.49	65.56	2.36	1.20	100.00	14.0
13	3.12-3.14	22.39	6.98	0.34	67.55	1.98	0.76	100.00	18.0
14	3.14-3.16	23.06	7.27	1.09	65.92	1.69	0.97	100.00	8.5
15	3.16-3.18	25.97	7.91	0.97	63.50	1.79	0.85	100.00	6.0
16	3.18-3.20	25.94	8.19	1.06	62.36	1.65	0.80	100.00	4.0
17	3.20-3.22	26.78	7.45	1.22	62.52	1.65	0.38	100.00	3.5
18	3.22-3.28	28.02	4.98	2.90	62.46	1.39	0.25	100.00	5.0
19	3.28-3.33	21.92	6.61	9.95	59.70	1.59	0.23	100.00	1.0
20	3.33	11.56	4.89	36.49	42.13	1.47	0.16	100.00	3.0

Table 1: Results of the centrifugal separation and chemical composition of separated clinker fractions

No. of Fraction Range of Size (in) dia. (in)	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100		101		102		103		104		105		106		107		108		109		110		111		112		113		114		115		116		117		118		119		120		121		122		123		124		125		126		127		128		129		130		131		132		133		134		135		136		137		138		139		140		141		142		143		144		145		146		147		148		149		150		151		152		153		154		155		156		157		158		159		160		161		162		163		164		165		166		167		168		169		170		171		172		173		174		175		176		177		178		179		180		181		182		183		184		185		186		187		188		189		190		191		192		193		194		195		196		197		198		199		200		201		202		203		204		205		206		207		208		209		210		211		212		213		214		215		216		217		218		219		220		221		222		223		224		225		226		227		228		229		230		231		232		233		234		235		236		237		238		239		240		241		242		243		244		245		246		247		248		249		250		251		252		253		254		255		256		257		258		259		260		261		262		263		264		265		266		267		268		269		270		271		272		273		274		275		276		277		278		279		280		281		282		283		284		285		286		287		288		289		290		291		292		293		294		295		296		297		298		299		300		301		302		303		304		305		306		307		308		309		310		311		312		313		314		315		316		317		318		319		320		321		322		323		324		325		326		327		328		329		330		331		332		333		334		335		336		337		338		339		340		341		342		343		344		345		346		347		348		349		350		351		352		353		354		355		356		357		358		359		360		361		362		363		364		365		366		367		368		369		370		371		372		373		374		375		376		377		378		379		380		381		382		383		384		385		386		387		388		389		390		391		392		393		394		395		396		397		398		399		400		401		402		403		404		405		406		407		408		409		410		411		412		413		414		415		416		417		418		419		420		421		422		423		424		425		426		427		428		429		430		431		432		433		434		435		436		437		438		439		440		441		442		443		444		445		446		447		448		449		450		451		452		453		454		455		456		457		458		459		460		461		462		463		464		465		466		467		468		469		470		471		472		473		474		475		476		477		478		479		480		481		482		483		484		485		486		487		488		489		490		491		492		493		494		495		496		497		498		499		500		501		502		503		504		505		506		507		508		509		510		511		512		513		514		515		516		517		518		519		520		521		522		523		524		525		526		527		528		529		530		531		532		533		534		535		536		537		538		539		540		541		542		543		544		545		546		547		548		549		550		551		552		553		554		555		556		557		558		559		560		561		562		563		564		565		566		567		568		569		570		571		572		573		574		575		576		577		578		579		580		581		582		583		584		585		586		587		588		589		590		591		592		593		594		595		596		597		598		599		600		601		602		603		604		605		606		607		608		609		610		611		612		613		614		615		616		617		618		619		620		621		622		623		624		625		626		627		628		629		630		631		632		633		634		635		636		637		638		639		640		641		642		643		644		645		646		647		648		649		650		651		652		653		654		655		656		657		658		659		660		661		662		663		664		665		666		667		668		669		670		671		672		673		674		675		676		677		678		679		680		681		682		683		684		685		686		687		688		689		690		691		692		693		694		695		696		697		698		699		700		701		702		703		704		705		706		707		708		709		710		711		712		713		714		715		716		717		718		719		720		721		722		723		724		725		726		727		728		729		730		731		732		733		734		735		736		737		738		739		740		741		742		743		744		745		746		747		748		749		750		751		752		753		754		755		756		757		758		759		760		761		762		763		764		765		766		767		768		769		770		771		772		773		774		775		776		777		778		779		780		781		782		783		784		785		786		787		788		789		790		791		792		793		794		795		796		797		798		799		800		801		802		803		804		805		806		807		808		809		810		811		812		813		814		815		816		817		818		819		820		821		822		823		824		825		826		827		828		829		830		831		832		833		834		835		836		837		838		839		840		841		842		843		844		845		846		847		848		849		850		851		852		853		854		855		856		857		858		859		860		861		862		863		864		865		866		867		868		869		870		871		872		873		874		875		876		877		878		879		880		881		882		883		884		885		886		887		888		889		890		891		892		893		894		895		896		897		898		899		900		901		902		903		904		905		906		907		908		909		910		911		912		913		914		915		916		917		918		919		920		921		922		923		924		925		926		927		928		929		930		931		932		933		934		935		936		937		938		939		940		941		942		943		944		945		946		947		948		949		950		951		952		953		954		955		956		957		958		959		960		961		962		963		964		965		966		967		968		969		970		971		972		973		974		975		976		977		978		979		980		981		982		983		984		985		986		987		988		989		990		991		992		993		994		995		996		997		998		999		1000		1001		1002		1003		1004		1005		1006		1007		1008		1009		1010		1011		1012		1013		1014		1015		1016		1017		1018		1019		1020		1021		1022		1023		1024		1025		1026		1027		1028		1029		1030		1031		1032		1033		1034		1035		1036		1037		1038		1039		1040		1041		1042		1043		1044		1045		1046		1047		1048		1049		1050		1051		1052		1053		1054		1055		1056		1057		1058		1059		1060		1061		1062		1063		1064		1065		1066		1067		1068		1069		1070		1071		1072		1073		1074		1075		1076		1077		1078		1079		1080		1081		1082		1083		1084		1085		1086		1087		1088		1089		1090		1091		1092		1093		1094		1095		1096		1097		1098		1099		1100		1101		1102		1103		1104		1105		1106		1107		1108		1109		1110		1111		1112		1113		1114		1115		1116		1117		1118		1119</	

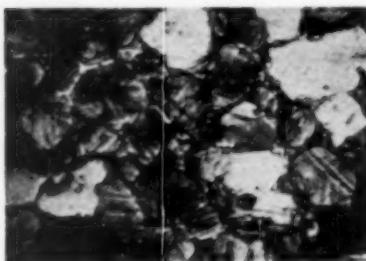


Fig. 4: Photomicrograph obtained in reflected light. 150 magnifications

In the centrifugal separation of ordinary cement clinker, it was found in the preceding reports that  $C_A$  and  $C_S$  are always condensed in lighter fractions, while  $C_S$ ,  $CAF$  and  $MgO$  are in heavier fractions. The range in specific gravity of separated fractions falls mostly within 2.9 to 3.2, while in the case of this special cement, the range of specific gravities is much greater. This shows that the clinker contains, though not in a large quantity, some ingredients different in specific gravity from the well known clinker components. In the lighter substance, calcium sulfide can be expected and in the heavier one the metallic iron can be expected. This can be proved by the high content of sulfur in the chemical analysis of lighter fractions and high percentage of metallic iron in the heaviest fraction.

It can also be foreseen in Table 1 that  $C_A$  (sp. gr. 2.97) would exist in the specific gravity range 2.86 to 3.06, and  $C_S$  (sp. gr. 3.15) in the range 3.06 to 3.18, while  $C_S$  is in the comparatively heavier fractions. These expected figures show conformity with the results of X-ray examination as will be shown later.

For the X-ray examination, eight typical fractions were chosen for samples. The X-ray tube and camera were the same as in the preceding reports, and the precision method was also adopted, adding 30 percent  $NaCl$  to each sample.

In Table 2, X-ray diffraction patterns of clinker fractions in comparison with those of  $C_S$  in alite,  $C_A$  in commercial portland cement,  $\beta$ - $C_S$ ,  $CAF$ ,  $Ct$  and  $\alpha$ -Fe are given.

As the sample of alite, the clinker fraction containing about 80 percent  $C_S$  (calculated by Bogue's method) was separated from a commercial high-early strength portland cement clinker and used, while as  $C_A$  in portland cement, a clinker fraction containing 26.6 percent  $C_A$  (calculated by Bogue's method) was separated from a portland cement high in alumina.

In Table 2, it is to be seen that  $C_S$  appears in full density in clinker fractions No. 10, No. 13 and No. 15, with which the diffraction patterns coincide exactly with those of  $C_S$  in alite.

$C_A$  appears in greater range, but in strongest density in fractions No. 4 and No. 8 to which the patterns conform with  $C_A$  in commercial portland cement.  $C_S$  as it appears in No. 15 and No. 20 shows the same diffraction patterns as  $\beta$ - $C_S$ .

Calcium sulfide appears in full density in the lightest fraction No. 1, while metallic Fe is the heaviest fraction No. 20.

From the results of the X-ray examination it is shown that the alite and  $C_A$  in the cement clinker manufactured by the Bassett process are quite the same in composition as those in commercial portland cement clinker, and that  $C_S$  exists in the clinker in the state of  $\beta$ - $C_S$ .

### Summary and Conclusion

The constitution of the cement clinker obtained from the Bassett process was examined by means of microscope and X-ray. In the microscopic examination of polished and etched sections of the clinker, very well-formed hexagonal crystals of alite were observed which showed mostly clear zoned structures.  $C_A$  was also found in well-formed rectangular isotropic crystals, and it was often ob-

served that alite forms with the crystal of  $C_A$ , and also appears sometimes in the center of  $C_A$  as a crystal bud. These phenomena show the possibility of formation of solid solutions between alite and  $C_A$ , and the growing of alite, making  $C_A$  one of the mother substances.

X-ray examination shows that alite and  $C_A$  in the clinker give exactly the same X-ray diffraction pattern as alite and  $C_A$  in the commercial portland cement clinker.

$C_S$  was observed in the clinker in the form of round grains of which some have interpenetrating striation, and others parallel ones. It appears sometimes in a band form in alite crystal. By X-ray investigation, it was proved that the  $C_S$  in the clinker exists in the state of  $\beta$ - $C_S$ .

In addition to the above mentioned principal crystals, the existence of calcium sulfide and  $\alpha$ -Fe in this special clinker was recognized, though their amount is not so great.

From the results of the examinations it seems to be very probable that alite in commercial portland cement clinker is not pure  $3CaO \cdot SiO_2$  but a solid solution of chiefly  $3CaO \cdot SiO_2$  and a certain quantity of  $3CaO \cdot Al_2O_3$ .

### References

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- (2) Tavasci, *Giorn. chim. Ind. applic.*, No. 16, pp. 173, 538 (1938).
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- (4) Insley, H., Flint, E. P., Newman, E. S., and Swenson, *Ibid.* 21, 355 (1938).
- (5) Koyanagi, K., and Sudoh, T., *Zement*, No. 28, p. 563 (1939).
- (6) Insley, H., *J. Research Natl. Bur. Standards*, 17, 353 (1936).
- (7) Sandius, *Ang. Allgem. Chem.*, No. 281, p. 343 (1935).

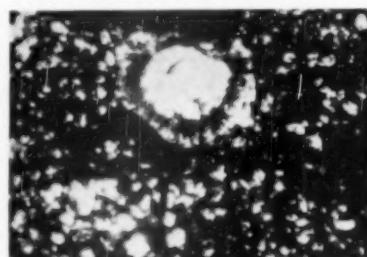


Fig. 5: Photo obtained in transmitted light. 100 magnifications (Nicol's)

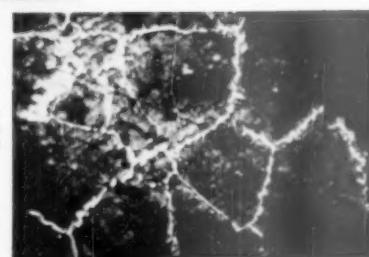


Fig. 6: Photomicrograph obtained in reflected light. 150 magnifications

**J. P. Loomis Coal and Supply Co., Akron, Ohio, recently installed perlite expansion plant as an addition to its aggregates and ready-mixed concrete plants and plaster mill**



Transit-mixed concrete truck leaves yard of J. P. Loomis Coal and Supply Co. Sand and gravel plant can be seen, left

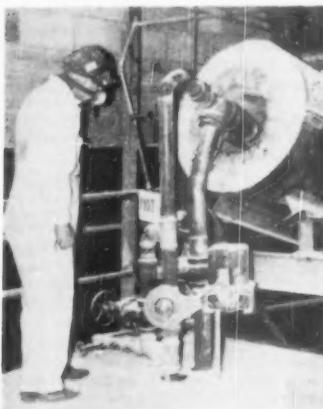
## **Hold Open House at New Perlite Expanding Plant**

**A**N OPEN HOUSE held recently by the J. P. Loomis Coal and Supply Co., Akron, Ohio, marked the opening of the company's new perlite expanding plant in that city. Visitors were taken on tours through the new plant, as well as through the established plaster mill, sand and gravel plant, and ready-mixed concrete plant. A

display in the office and warehouse presented the advantages to be gained through the use of perlite aggregate, and stressed the water repellency, light weight, and insulation characteristics by means of graphic displays. Also displayed were samples of block, brick, plaster, concrete and insulation.

Visitors to the open house saw what

was said to be the first completely automatic expanding plant in the industry. Fuel feed, air and gas pressure are all maintained by automatic controls. Crude perlite, shipped from deposits at Texas Creek, Colo., worked by Alexite Engineering Co., is expanded in a Muehleisen furnace at temperatures from 1800 to 2400 deg.



Left: Checking kiln flame in perlite plant. Heat, air pressure, gas pressure and feed all are controlled automatically in this plant which is said to be the first completely automatic operation in the industry. Center: After the bags are filled with perlite, they are weighed and then secured with heavy wire ties. Material is sized and proportioned by air and vacuum currents in the plant, eliminating screens and grinding. Right: Machine packs both 50- and 100-lb. bags with masons mortar. Gravity packer also is used for handling sanded plaster, cement finish, silica sand and dried masons sand



## DIVERSIFICATION



Left: Visitors inspecting displays in main warehouse during recent open house. Concrete block, brick, plaster, concrete and insulation were shown. Right: Checking a load of concrete being poured in the construction of Shaw Sanatorium near Akron, Ohio. This concrete, used for roof insulation, was a 1:8 mix and was placed about 4 in. thick.



F. Natural gas is used for fuel. No screens or grinders are used at the plant; sizing is accomplished by air separators. The finished product is packed in 4-cu. yd. sacks. Weights conform to A.S.T.M. specifications of 8 to 9 lb. for plaster aggregate and 12 to 15 lb. for concrete aggregate. The perlite is being marketed as Ohio Perlite.

The plaster mill also was of interest to the visitors. There the company makes ready-to-use mortar and cement finish, many kinds of packaged sands, sanded plaster, sand grit, playbox sand, silica sand and dried masons sand.

### Bleeding of Portland Cement-Water Mixtures

A NEW APPARATUS recently developed at the National Bureau of Standards, Washington, D. C., provides for direct and continuous measurement of the bleeding in portland cement-water mixtures within the range of practicable water-cement ratios. This equipment, designed by R. Valore, Jr., in collaboration with J. E. Bowling and R. L. Blaine, gives highly reproducible bleeding data regardless of the experience of the operator. A further advantage lies in the fact that the equipment required is inexpensive and of simple construction, the Bureau states. Bleeding of freshly mixed neat cement pastes, mortars, and concretes results from the consolidation of the mass of suspended solids, due essentially to gravitational forces. In its most troublesome form, bleeding occurs at rates sufficiently high to produce "channeling"; the water then moves through vertical channels to the surface with such force that appreciable quantities of very fine cement particles are carried in suspension. When deposited at the channel openings on

the surface of concrete, these particles hold sufficient water to form a paste of high water-cement ratio. This, after the material has hardened, constitutes a plane of weakness. High bleeding rates may account also for water pockets and loss of bond at the underside of coarse aggregate restricted from settlement, as in narrow forms and at the underside of horizontal reinforcement.

The new apparatus permits the collection of bleeding water from a selected area on the upper surface of a cement-water mixture. A liquid, such as carbon tetrachloride, having a specific gravity intermediate between that of water and the cement-water mixture, is used as a displacement medium. A further requirement is that the liquid medium be immiscible with water and not react with the constituents or hydration products of portland cement. When such a liquid is placed over the sample of the cement-water mixture, bleeding water appearing at the surface of the mixture will rise through the liquid. In the present apparatus the bleeding water rises into a buret for measurement, while the head of liquid bearing upon the surface of the sample does not exceed 0.75 in. Parallel series of tests using the liquid displacement apparatus and by measuring the subsidence of a float placed upon the paste surface indicate the dependence of bleeding upon the settlement of the solid particles.

The Bureau of Standards has concluded, as a result of its tests, that previously used bleeding tests for concrete, which yield values for bleeding capacity only, and without reference to corresponding neat pastes, may furnish misleading results. Should the tendency of the aggregate to arrest bleeding be compensated by bleeding in the interior of a concrete, the hardened material may be affected adversely.

The more useful data would appear to be the valuation of the arrestance effect, which would require testing by a continuous and reproducible method not only the concrete, but also a neat paste having the same water-cement ratio.

The principles involved in the method for measuring bleeding described here form the basis of a method proposed by the American Society for Testing Materials subcommittee on Bleeding, Plasticity, and Workability.

### Portland Cement Production

THE PORTLAND CEMENT INDUSTRY produced 18,040,000 bbl. of finished cement in November, 1949, as reported to the Bureau of Mines. This represents a decrease of 2 percent compared with the output in November, 1948. Mill shipments totaled 17,269,000 bbl., a decrease of 5 percent from the November, 1948, figure, while stocks of 9,340,000 bbl. were 46 percent greater than the total for the same month of 1948. Clinker production during November, 1949, amounted to 17,854,000 bbl.

### Correction

ON PAGE 114 of the December, 1949, issue of *ROCK PRODUCTS*, in the report of the National Industrial Sand Association meeting, R. S. Lebold was quoted as saying that the Canadian railroads had equipped most of their box cars with holes in the top for loading bulk material. However, Mr. Lebold said instead that he knew of some cars being equipped in this manner for movement of a certain bulk chemical and that he had taken it up with the Canadian railroads to see if their cars should not be equipped that way for silica loading and movement.

# INFORMATION

TO HELP YOU MEET TODAY'S PROBLEMS AND TO MAKE PLANS FOR TOMORROW

You can obtain catalogs listed on these pages by merely checking and mailing the coupon below

**1 AIR CYLINDERS**—The Bellows Co. has released Bulletin PD-120, describing and illustrating various models of the Power Dome air cylinder. Dimensional drawings on different types of mounts and different sizes are given.

**2 AXLES**—The United Mfg. Co. has announced a 12-page catalog, No. 101, describing and illustrating two-wheel (capacities up to 6000 lb.) and four-wheel (4000 to 12,000 lb. capacities) Caravan axle assemblies, designed for transportation of generators, concrete mixers, pumps, drills and compressors, etc. Specifications and data charts are included.

**3 BAGS**—Bemis Bro. Bag Co. has published a 16-page "Pocket Guide to Bemis Products," briefly describing and illustrating more than 40 general types of products manufactured by the company. Included are cotton, paper, burlap, transparent, open-mesh and waterproof bags, canvas tents, tarpaulins, thread and twine, packer-aids, packaging systems, etc.

**4 BALL BEARINGS**—New Departure Div. of General Motors Corp. has released a 16-page booklet describing and illustrating various types of ball bearings for conveyor systems. Line drawings, dimensional and load capacity data, and photographs of installations together with performance records are also included.

**5 BREAKERS**—New Holland Mfg. Co. has announced a 16-page catalog, Form 100A1, describing and illustrating Models 1212, 2020, 3030, 4040 and 5050 impeller breakers. Cutaway drawings, specifications and photographs of installations are given.

**6 COMPRESSION TESTER**—Forney's Inc. released a 4-page bulletin describing and illustrating a portable compression tester for testing compressive strength of concrete building units. It is said to exert a ram pressure of 175 tons, is equipped with a calibrated pressure gauge for direct reading in pounds per sq. in., and has dual-manually-operated pumps.

**7 COMPRESSORS**—Joy Mfg. Co. announces a new 16-page bulletin, No. A-56, on the WL-80 Unistar two-stage, air-cooled compressors. A selector chart, sectional drawings, and construction features are included. Compressors are available in 11 sizes, 15 to 125 hp., with piston displacements from 81 to 640 c.f.m. at 125 max. pressure.

**8 CONCRETE REINFORCING**—Cedar Rapids Block Co. has published a 4-page bulletin describing and illustrating Dur-O-Wal steel members for reinforcing masonry walls using concrete block, lightweight block, clay tile, brick, etc. Rods are manufactured of high tensile steel, electrically welded, are said to have a strength of 100,000 lb. p.s.i. and are made for 4-, 6-, 8-, 10-, 12- and 13-in. wall thicknesses in 10-ft. lengths.

**9 CONVEYORS**—Lake Shore Engineering Co. announces publication of an 8-page catalog No. 498 showing Tote-All lightweight, portable power conveyors for handling bulk materials and packaged goods. Photographs, application and specification data are also given.

**10 CRANE BRAKES**—General Electric Co. bulletin CEA-5194 describes and illustrates the 2-shoe, 2-magnet d-c brake for hoists, cranes, conveyors, etc. Construction features, cutaway views, ratings and dimensions are also shown.

**11 CRANES**—Power Crane & Shovel Association has released an operating cost guide, Technical Bulletin No. 2, as an aid in estimating cost of ownership, operation and maintenance of power cranes, shovels, hoes, draglines and clamshells, in capacities of  $\frac{1}{2}$  to  $2\frac{1}{2}$  cu. yd. and  $2\frac{1}{2}$  to 50 tons. Copies of the bulletin may be obtained for 50¢ by writing to the Association at 74 Trinity Place, New York, N. Y.

**12 CRUSHERS**—American Pulverizer Co. has issued a 6-page bulletin on laboratory crushers, grinders and shredders for reduction of bauxite, gypsum, lime, limestone, magnesite, mica, oyster shells, phosphates, pumice stone, rock wool, shale, etc. Booklet is entitled "For Better Testing and Small Scale Reduction."

**13 CURING COMPOUND**—Aluminum Industries, Inc. has issued a 4-page bulletin, describing and illustrating Permalite membrane concrete curing compounds, V-167 for horizontal concrete surfaces and for vertical surfaces below ground, and V-169 for vertical concrete surfaces where non-discoloration is an important factor. Compounds are applied by spraying. Description of technical features, methods of application, and testing laboratory report are also given.

**14 CYLINDERS**—Ledeen Mfg. Co. has published a technical bulletin, CS-929, describing and illustrating the use of pneumatic actuating cylinders on concrete block machines to provide nearly automatic operation. Cylinder details and application information are also given. Bulletin 453 giving dimensions, capacities, weights, applications and other engineering data is also available.

**15 DIESEL ENGINES**—Cummins Engine Co. Inc. has issued two bulletins, Nos. 5287 and 5288, describing and illustrating models HR-600 and HRS-600 diesel engines, respectively. Specifications, lists of standard equipment, installation drawings, etc., are included.

**16 DIESEL ENGINES**—Nordberg Mfg. Co. has released four bulletins, Nos. 166, 167, 167-A and 168, giving specifications, detailed information and outline drawings of Model 4FS-1 diesel engines as adapted to power take-off with and without clutch (167 and 167-A), generating units (166), and pumping units (168). The 4-cycle, one cyl., diesel engines are rated at 15 hp. at 1800 r.p.m. and 18 hp. at 1200 r.p.m.

**17 DIESELS**—International Harvester Co. has released a 24-page bulletin describing and illustrating models UD-24, UD-18A, UD-18, UD-14A, UD-9 and UD-6 diesel of 180, 125, 100, 75, 55 and 35 hp., respectively. Construction features, cutaway views, performance charts, specifications and dimensions are also included.

**18 DRILL BITS**—Rock Bit Sales & Service Co. has issued a 4-page bulletin describing and illustrating crown-designed Rok-Bits for drills. The bits are available in the 2-point, chisel type in sizes  $1\frac{1}{2}$  to 4-in. dia., and in the 4-point, cross bit type in sizes  $1\frac{1}{2}$  to 4-in. dia. Power and hand chisels, carbide-tipped bits, Saber points (concrete breaking points), nail points, etc., are also available.

**19 DRIVES**—Link-Belt Co. has issued a 28-page catalog and engineering data book No. 2385 on fluid drives to replace previous catalogs on this subject. Types, sizes, arrangements and dimensions of units available, construction features, selection tables, and photographs of actual installations are included.

**20 DUST COLLECTORS**—Prat-Daniel Corp. has issued Bulletin S-250-V, describing and illustrating the Valsom Type S tubular dust collector.

**21 EXPLOSIVES**—Illinois Powder Mfg. Co. has published a 40-page pocket-size explosives handbook giving detailed information on the characteristics of various types of explosives. A reference guide for determining quantities of explosives required in specific applications is also included.

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**22 EXCAVATORS**—Power Crane and Shovel Association, 74 Trinity Place, New York 6, N. Y., has issued a 24-page bulletin, Technical Bulletin No. 3, dealing with proper sizing of excavators and hauling equipment, also proper synchronization of hauling fleet with excavator. Subject matter could be used as text material for engineering colleges, students, professional engineers and others dealing with excavating problems. Copies may be obtained from Association for 50¢ each.

**23 FIELD SERVICE UNIT**—Davey Compressor Co. has announced Bulletin E-232, describing and illustrating a truck-mounted Field service unit, Type PW-308, for use in servicing machinery operating in areas distant from service centers. A floor plan shows location of welder, generator, compressor, power lubrication equipment and supplementary items.

**24 FLAME CUTTING**—Joseph T. Ryerson & Son, Inc., has published a 4-page bulletin illustrating unusual steel shapes, such as sprockets, grinding wheels, boom bars, crank shafts, ornamental iron railings, signs, etc., cut to order with the Electric-Eye flame cutting equipment.

**25 FORK TRUCKS**—Lewis-Shepard Products, Inc., bulletin No. 28 describes and illustrates various models of electric and gas-electric fork trucks. Specifications, dimensional drawings, engineering and operational features are included. Also covered is the complete line of "SpaceMaster" electric fork trucks.

**26 FORK TRUCKS**—Yale & Towne Mfg. Co. has published Bulletin P-1170, giving hints and helps on operating gasoline fork trucks safely and with a minimum of wear to moving parts.

**27 GRADERS**—Caterpillar Tractor Co. has released a 16-page booklet, Form 12250, illustrating the adaptability of motor graders to various methods of road maintenance on coast-to-coast projects.

**28 HOISTS**—Detroit Hoist & Machine Co. has released Bulletin 725-B, describing and illustrating various types of electric hoists and traveling cranes.

**29 HOSE**—The B. F. Goodrich Co. has published a six-page catalog section, No. 3740, describing and illustrating various brands of industrial fire hose. Data on size, couplings and test pressures are given, together with descriptions of gaskets, fittings and couplings used with the hose.

**30 INDUCTION MOTORS**—Electric Machinery Mfg. Co. has issued a 32-page booklet, No. 28, covering the basic theory, operation, characteristics and applications, and control of large induction motors. Photographs, cutaway views and graphs are also shown.

**31 JACKS**—Templeton, Keenly & Co. has issued an engineering data bulletin, Industrial 49, describing and illustrating Simplex jacks and related equipment. Also included are Simplex-Jenny center hole hydraulic pullers, Util-A-tool set, together with specification charts, selection guide and price listings.

**32 LIFTERS**—Fucel Enterprises, Inc., has released a 4-page bulletin describing and illustrating the Gonsner grizzly lifter for handling bulky materials in machine shops, boiler and welding shops, heat treating plants, etc. Specifications and typical applications are also shown.

**33 LIFT TRUCKS**—Barrett-Cravens Co. has released Bulletin 4881, describing and illustrating various types of materials handling equipment, such as lift trucks, elevators and storage racks.

**34 LIFT TRUCKS**—The Buda Co. has issued a 2-page bulletin, H-1444, describing and illustrating Model F-50 fork lift truck of 5000-lb. capacity at 20-in. load center. Specifications, together with operating and lifting data, are also given.

**35 LOADERS**—The Euclid Road Machinery Co. has released a 24-page booklet, Form J-405, describing and illustrating loaders for high speed loading of large hauling units. Booklet contains many operating views showing loaders at work on various jobs.

**36 OILERS**—Gits Bros. Mfg. Co. has issued an 8-page booklet featuring the complete line of Gits visual oilers, including data on applications, specifications, etc.

**37 PAINT**—Speco, Inc. has published data sheet and application bulletin on Heat-Rom, a heat resisting aluminum paint for use on interior or exterior hot surfaces subject to 1000 deg. to 1500 deg. F. It may be applied by brush or spray and is said to resist fumes, moisture and acids.

**38 PUMPS**—DeLaval Steam Turbine Co. has published Catalog 1550, describing and illustrating opposed impeller pumps in pressures to 1000 p.s.i. Both 2- and 4-stage units are shown, together with rating and dimension tables.

**39 RESPIRATORS**—Mine Safety Appliances Co. has released Bulletin No. CR-23, describing and illustrating the Gas-Fume respirator, with twin replaceable filters mounted on back of wearer, for protection against mists, dusts, fumes, organic vapors and acid gases.

**40 SCRAPERS**—Caterpillar Tractor Co. has published a 16-page bulletin, Form 12311, showing applications of tractor-scrapers in clearing land, cut and fill work, short and long hauls. Also presented are powered units adapted for draglines and shovels, compressors, rollers, force feed loaders and crushers, including diesel motor graders for road surfacing.

**41 SEPARATORS**—Southwestern Engineering Co. has released Bulletin 906, describing and illustrating the Sisco separator for handling materials through screens of 100-mesh (dry) and 200-mesh (wet). Samples of materials screened by standard 48-in. model are: For wet screening clay slip—1.62 sp.g., 150-mesh; feed, 25,000 lb. per hr.; dry screening foundry sand—16-mesh scalp onto 80-mesh; feed, 30,000 lb. per hr., and ground glass—30-mesh scalp onto 100-mesh. Specifications, cross-sectional views and construction features are given.

**42 STARTERS**—Allis-Chalmers Mfg. Co. has issued Bulletin 14-B-7274, describing and illustrating Type 371 starters for control of squirrel cage motors and the primary of wound rotor motors of 350 hp. or less at 2300 volts. Starter is completely sealed, weather-proof and can be used for outdoor installations. Dimensions and wiring diagrams are also given.

**43 TRACTORS**—Detroit Hoist & Machine Co. Bulletin 810 describes and illustrates the Trojan monorail tractor, designed for operating on existing monorail tracks or crane runways and applicable to any type of hoist or crane. Typical applications and dimension diagrams are included.

**44 TRANSFORMERS**—Acme Electric Corp. has issued Catalog AC-178, giving detailed specifications and improvements in design and construction of air-cooled transformers from 1/10th Kv.-a. to 50 Kv.-a. Wiring diagrams and charts are included.

**45 WIRE ROPE**—Macwhyre Co. has announced Bulletin 49-30, cataloging 133 different sizes and types of stainless and monel metal wire ropes. Typical uses for each rope are listed, also the various types available.

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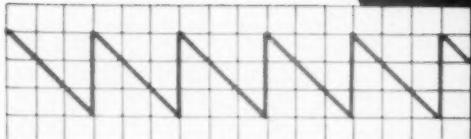
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Apparently enjoying the meeting, left to right in left picture, H. C. Krause, Columbia Quarry Co.; George M. Baker, G. M. Baker Co.; and John Stark, J. J. Stark Contractors; and to right, V. M. Runkquist, Clark & Runkquist Construction Co.; J. C. Kendrick, program specialist, P. & M. A.; and Russell Boulton, Railsback & Boulton Co.



## Missouri Agstone Producers Discuss Conservation, Liming

MISSOURI LIMESTONE PRODUCERS ASSOCIATION held its 3rd annual meeting December 9-10 at the Hotel Governor in Jefferson City, Mo. Arthur R. Alvis of Butler, secretary-treasurer of the association, opened the first session and J. J. Griesemer, Billings, association president, gave a short address of welcome. Mr. Alvis then introduced the Hon. George H. Christopher, U. S. Congressman from Missouri's 6th Congressional district, a man who, Mr. Alvis said, has done much to contribute to the promotion of soil conservation not only in his home state but in the whole country. Mr. Christopher launched immediately into what he said was his favorite subject—soil conservation. Though lime is not the most important item in conserving the nation's soil, he began, nonetheless the role of the limestone producer should not be underestimated. Liming will do the most to pay for itself, but terracing needs to be preached and practiced more widely. Spreading lime on terraced land is very important, but other things needed to improve the country's farms are waterways and concrete structures, Mr. Christopher declared.

### Conservation Progress Discouraging

Mr. Christopher related how silted the streams in his part of the state are becoming, indicating the loss of good soil upstream. It is discouraging to see what has been done, then realize what remains to be done in the next few years in the country's soil conservation program, he said. Too many farmers do not realize the importance of proper liming and depend upon poor hay to feed their livestock. In the event of discontinuance of government funds for the support of limestone purchases, Mr. Christopher expressed a fear that the farmer would economize first by stopping the spreading of limestone. However,

farmers do appreciate the role of limestone producers, he said, and for the most part will cooperate in conservation practices.

Robert M. Koch, executive secretary, National Agricultural Limestone Association, Washington, D. C., gave a short report on the Washington scene. He said that the future of the Agricultural Conservation Program was bright and that much progress has been made. More effort will have to be made to reach wartime levels of limestone consumption, however. During the war fertilizer was in short supply but plenty of limestone was available, resulting in the setting of new records for the consumption of the latter. The A.C.P. funds for the current year have been restored to \$285,000,000 following a cut by Congress to \$150,000,000. The program could use \$500,000,000 annually, Mr. Koch said. A survey made by state agronomists has shown that the more than 35,000,000 tons of liming material used during the entire war period are needed annually on the nation's farms.

Lime sales may suffer, Mr. Koch said, since a survey shows that farm income will probably be down 22 percent, whereas the goods he buys will decline only 4 percent. All producers should note the effect of the farmer's having to pay 40 percent of the cost of liming materials, he said. Also mentioned was the bill now before Congress to modify purchase orders to allow the forms to carry prices on them. Mr. Koch remarked that he felt the percentage depletion legislation has lost out after failing to pass both houses of Congress.

The featured speaker at the association banquet was Dr. W. A. Albrecht, chairman, Department of Soils, University of Missouri, Columbia. Toastmaster for the occasion was Ben P. Donnell, Valley Dolomite Corp., St. Louis. The initial speaker was Jim Meredith, an advisor to Gov-

ernor Smith of Missouri, who reported on the state's rural road program. He discussed the factors involved in Missouri's low gasoline tax of 2c and stated that recently the state Senate passed a resolution calling for a referendum vote on April 4 to decide whether the tax is to be increased to 4c. Several years ago, Mr. Meredith said, the state voted a bond issue for roads. The revenue from that source has been spent, and now the state must have another source of revenue. The limestone producers have a direct stake in the outcome of the election, Mr. Meredith stated, since the program last year used over a million tons of limestone for roads and next year's program will call for 3,000,000 tons.

### Soil Nutrition

The theme of Dr. Albrecht's talk was "Soil Nutrition at Home and Abroad." The practice of liming began in 1910 in Missouri, he said, though it is an ancient practice that started with the Romans. Liming was put on a scientific basis at the turn of the century, though this did not augur well at the outset because of the scientist's extravagant claims of its benefits. It is common to explain the effects of some material by picking on the wrong one of two explanations, the speaker said. This was the case in explaining the beneficial effects of liming, a practice that furnished calcium and reduced acidity simultaneously. It was natural to assume that it was the removal of acidity that was of direct benefit. However  $\text{NaCO}_3$  will not help plant growth even though it reduces acidity. By chance, Dr. Albrecht continued,  $\text{CaCO}_3$  was picked for liming purposes, and when it helped plant nutrition the causes were explained the wrong way. No longer can farmers go on the assumption that if a little lime is good, more will be better. The addition of too much lime will remove too many other nutrients.

(Continued on page 142)

## Labor Relations Trends

*(Continued from page 77)*

contribution in social security taxes. In other words, it would appear that if a pensioner were entitled to the minimum company pension and a \$40 social security pension, he could actually acquire \$120 in pensions.

### Other Benefits

If a pensioner is entitled to or paid discharge, liquidation or dismissal or severance allowance, this sum may in the discretion of the board be deducted from the amount of the pension to which the pensioner would otherwise be entitled. The same condition applies to payments for disability caused by injury or occupational disease, for which the company is liable, except for fixed payments for loss of any bodily member (an arm, leg, etc.). The pension payments are to be monthly, except in the case of pensions of less than \$600 per year, which the board may elect to pay quarterly.

The rules governing determination of continuous service are more or less complicated as would be expected. They are the chief drawback to individual company pensions, because of necessity they must restrict the freedom of the employee to change his job. The following general principles govern, in this agreement: "(1) There shall be no deduction for any time lost which does not constitute a break in continuous service; (2) Continuous service shall be broken: (a) quit; (b) discharge, provided that if the employee is rehired within six months the break in continuous service shall be removed; (c) permanent shutdown of a plant, department or subdivision, provided that if the employee is rehired within two years the break in continuous service shall be removed; (d) absence due to layoff or a physical disability either of which continues for more than two years, except that absence in excess of two years due to compensable disability incurred during the course of employment shall not break continuous service, provided such individual is returned to work within 30 days after final payment of the statutory compensation for such disability."

### Administration

The administration of the pension plan is entirely in the hands of the management. In cases of controversy which may arise from (a) the number of years of continuous service; (b) age of the pension applicant; (c) average monthly compensation used for pension calculation; (d) determination as to whether or not an applicant is permanently disabled, the board of directors is to select one representative and the union another, and the two are to decide upon an impartial umpire, whose decision will be binding on both parties. However, the umpire is prohibited from deciding any issue except that arising

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says Roy Webster, Bundy Concrete, Sherbourne, N. Y.



Here is another example of Seco performance on the job! The Seco pictured above is one of 5 now in constant daily operation at the Bundy Concrete Company's plant. For maximum capacities, correct sizing and trouble-free operation, you can't beat Seco.

The modern, efficient plant layout of the Bundy Concrete Company, naturally calls for Seco vibrating screens. Seco's controlled, true circular action is a boon to good production.

In the words of Mr. Roy Webster, Sup't at Bundy, "For smooth, consistent operation, nothing else compares with a Seco. Our five Secos are never shut down for repairs."



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from one of the four points mentioned.

The agreement expressly provides that no employe prior to his retirement under the eligibility rules given shall have any vested rights or interest in the pension fund; and employment rights shall not be enlarged or affected by reason of the pension provisions.

There is to be established a joint pension committee, composed of representatives of management and union (10 members, 5 of each) who are to be kept informed annually of the pension program in so far as it affects employees, but this committee has no part in the management of the pension fund, since this is the sole responsibility of the directors of the company.

In return for signing this agreement the union has agreed "to freeze" the plan, that is not ask for more pension, or more wages to make up for pension deductions until after December 31, 1951. However, either party may reopen the present collective-bargaining contract on November 1, 1950, after due notice, to negotiate with respect to general and uniform changes in rates of pay. If an agreement on this is not reached by December 31, 1950, either party may resort to a strike or lockout. In that event, this agreement is suspended until such wage changes are agreed upon, when the company is obligated to reinstate it.

### Stockpiling

*(Continued from page 110)*

Continental Gin Co. rubber impact idlers under the loading point of the belt.

The minus  $\frac{3}{8}$ -in. material that originates in the circuit tower in a manner similar to that of the coarse fraction, is carried up a belt to two 5- x 12-in. Robins vibrating screens. These screens produce the plus  $\frac{3}{8}$ -in. minus  $\frac{3}{8}$ -in. stone and the minus  $\frac{3}{8}$ -in. material. The minus  $\frac{3}{8}$ -in. material is piled in two separate piles over the reclaiming tunnel.

The sized stone from both of the two last mentioned groups of vibrating screens falls to its respective 24-in. inclined stacker belts that finger out over the reclaiming tunnel. All the stacker belts and all belts except the first four mentioned in the circuit were supplied by the Thermoid Co. and the others by the B. F. Goodrich Co. The idlers were supplied by Continental Gin Co. and Robins Conveyors, Inc. L. B. Smith of Camp Hill, Penn., was distributor for the conveyors in the primary and secondary crushing sections of the new plant. Bacon-Pietsch Co., Inc., worked out the detailed design of all transmission for the plant and conveyors, including the conveyors for the reclaiming tunnel. Medart roller bearings are used on the tail pulleys that are a part of the three stacker belts in the coarse rock section. Savary & Glaeser did the steel work in the new plant. At the time of inspection a dust collecting

system supplied by Precipitation Associates was being installed to take care of dust from the secondary crushers and the circuit tower.

The plant formerly operated by the company featured a Kern tower and it will be retained and special fine graded stone or fine trap rock materials that may have an agricultural interest will be accommodated in this section of the plant.

The company also has a black top plant at this site and is quite active in the promotion of asphaltic building materials.

#### Personnel

Offices of Kingston Trap Rock Co. are located at the plant. Linus R. Gilbert is president-treasurer of the firm, Irene L. Cullen is vice-president-secretary and Asa H. Farr is vice-president. Other officials include: A. B. Sine, sales manager; Nicholas J. McGowan, promotion director; Wm. H. Klein, charge of construction; Jos. S. Ostrowski, plant superintendent; Jack Smith, assistant plant superintendent; and Henry Buron, master mechanic.

#### Durability

*(Continued from page 114)*

mostly amorphous hydrated lime, which is not desirable for reasons noted. Some of the lime retained in the dicalcium silicate also is surplus and will be released in the course of time, but evidently these reactions are too slow to contribute to the disintegration of the concrete. The objective should be to design a cement with the right proportion of dicalcium silicate and sufficiently coarse and well balanced in particle size to counterbalance shrinkage from syneresis and expansion from continued hydration.

10. Air entrainment in concrete is helpful to salt solution and weather resistance for probably at least three reasons: (1) the air bubbles are enclosed in films of liquid which probably carry some of the minerals in solution, thus giving better distribution of both water and colloids throughout the mix; (2) the air pockets in the green concrete are compressible and therefore permit volume adjustments without rupturing stresses; this effect might last for several years, or as long as the concrete preserves its flowability under load; (3) it permits workable mixtures with a smaller water-cement ratio.

#### Schedule Peak Cement Production

NORTHWESTERN STATES PORTLAND CEMENT CO., Mason City, Iowa, made and shipped nearly 2,000,000 bbl. of cement during the year 1949 and expects to establish a new all time record before the end of 1950, according to Hanford MacNider, president. In the past two years the firm has spent approximately \$900,000 in plant and operational improvements.

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## Baughman FERTILIZER SPRAYER ATTACHMENT Holds the Spread to the Ground

For Baughman K and K-2 Bodies. Prevents wind from scattering lime and phosphate spreads. Confines air blast from whirling distributor and directs spreading materials outward and ground-ward. Causes the spread to LAY and STICK. Sprays limestone up to 30 feet . . . phosphates and other fertilizers up to 20 feet. NOTHING LIKE IT ON THE MARKET!

FOLDS TO 8 FEET easily and solidly for highway travel. Open (to 18 feet) and ready for work in a jiffy. Ruggedly built of 13 gauge alloy steel with no anchor braces or criss-cross rods. Heavy re-inforced hinges. No moving parts . . . all parts replaceable. Heavy rubberized canvas curtain. WRITE FOR PRICES AND FULL DETAILS.



PHOSPHATE SPREADER ATTACHMENT . . . covers 2 acres a mile at 15 mph. Regulated volume — 100 to 5000 lbs. per acre. 16½ wide . . . folds for highway travel.

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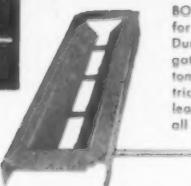


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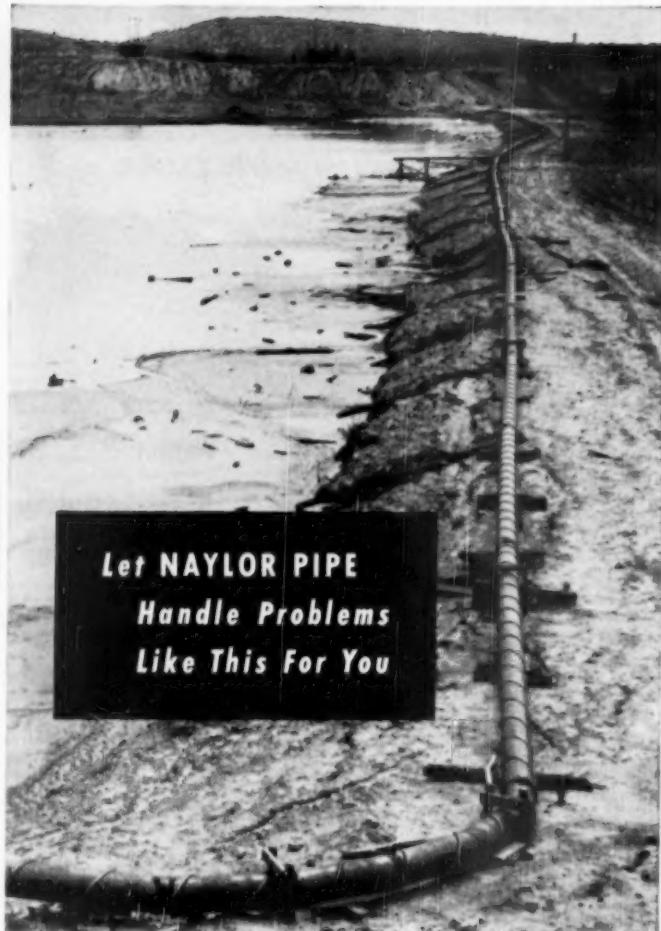
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BOTTOM DUMP . . . available for all Model ASK-2 Bodies. Dumps stone and other aggregates instantly through the bottom of the body. Positive eccentric locking action . . . will not leak non-fluid materials. Meets all highway requirements.



MARL SPREADER — also for mud, paper mill sludge, sewage, etc. Special model with beater and 2 distributors — not designed for dry lime, phosphate or other dry materials.



The tailings line shown here is typical of the way Naylor pipe fits into the mining picture. Naylor is the lightweight pipe with the exclusive Lockseam Spiralweld structure that makes it stronger and safer than other lightweight pipe. It's the practical, economical answer in mining service on high and low pressure water lines, air lines, hydraulicking, ventilating, suction lines, sludge lines, drainage as well as tailings lines. Sizes range from 4" to 30" in diameter—thickness from 14 to 8 gauge—all types of fittings, connections and fabrications. For details on Naylor Pipe and Naylor Wedge-Lock Couplings, write for Catalog 44.



## Missouri Agstone Meeting

*(Continued from page 138)*

needed by the growing plant. Furthermore, a soil will be in bad shape when all acidity is removed, the speaker said. There is more of a defense for the use of calcium than there is for the reduction of acidity, according to Dr. Albrecht. Calcium is one of the first requirements in plant growth, a tool in mobilizing an enormous number of nutrients. For instance, he pointed out, increasing the amount of calcium in the soil will permit more magnesium to pass the root membrane, magnesium which is needed for the production of the plant's green coloring matter.

The problem involved in an acid soil is not one of fighting the acidity, Dr. Albrecht stated, but of adding nutrients which the hydrogen of the acids has replaced. Addition of lime is the first step in rebuilding the soil's mineral content which was removed by what the soil expert termed "nature's primary assembly line of assimilation of organic matter." Inasmuch as other minerals are deficient in soils, limestone producers should give more than passing thought to hauling crushed rock high in magnesium content and blast-furnace slags containing manganese. Some copper, cobalt and boron compounds also may be necessary for various soils. Dr. Albrecht continued. In the past some limestones have been discarded because it was thought they were too impure. Thus it behoves all producers to learn the rudiments of plant nutrition, not only to remain in business, but to ensure that we will have sufficient food to eat in the future, warned the speaker. Already the protein content of corn is dropping as a result of soil depletion.

Dr. Albrecht discussed the important economic question of who should pay for soil rebuilding. Present taxation procedures are unfair wherein the farmer must pay an income tax for the sale of a food product that robbed his soil of some of the essential nutrients. The man who owns land takes goods out of that land and gets paid nothing for it. In contrast, the merchant has a return of about 60 percent after taxes for the sale of his product. The nation should help the farmer directly by providing a tax deduction for the removal of land resources, Dr. Albrecht stated. In his closing remarks the speaker expressed the hope that limestone producers would promote the addition of other plant nutrients to soils besides calcium.

## Election of Officers

A new board of directors of the association was elected at the final closed session. J. J. Griesemer, Billings, was re-elected president. Merl Hamill, Canton, was re-elected vice-president and W. T. Clark, Clark and Runquist Construction Co., Savannah, secretary-treasurer. Other mem-

bers of the board for 1950 include Ed Markwell, Auxvasse Stone and Gravel Co., St. Louis; Kenneth Kilkenny, West Plains; L. W. Hayes, Kansas City; George Baker, Lockwood; C. E. Thomson, Deitz Hill Development Co., Kansas City; and Ben P. Donnell, Valley Dolomite Corp., Farmington. Paul Doll will continue as association manager. Mrs. M. R. Cox is secretary.

### Calcining

*(Continued from page 121)*

the gas heat-exchanger at 627 deg. F. There are available in the kiln gases only those B.t.u.'s between 1385 deg. F. and 627 deg. F. or  
26 x 5504 x 1385 deg. F. — 627 deg. F.) = 855,000 B.t.u.  
which will raise the temperature of the air to  
26 x 5504 x (1385 deg. F. — 627 deg. F.) = 855,000 B.t.u.  
X = 1417 deg. F.

Of course this is impossible, since the kiln gases are at a temperature of only 1385 deg. F. Nevertheless this addition of heat to the air for combustion will result in a further decrease in the coal requirement so that eventually a balance would be reached such that the only loss of heat from the direct application to the process will be in the kiln gases passing from the system at 627 deg. F.

The perfect kiln being unattainable, we must contend with the practical kiln and bring it as closely as we can to the ideal. Since we must deal with all the weaknesses and shortcomings of this mammoth industrial tool, we must be prepared to attack the problems intelligently and not with hit-or-miss, or by-guess-and-by-god methods. Nevertheless a concept of the perfect kiln, though it may appear nebulous, will be of great help in solving many of the problems of the practical kiln.

### Perlite

*(Continued from page 96)*

aggregate that makes a hard, resistant plaster or concrete. It produces unusually white aggregate (possibly attributable to a trace of MnO<sub>2</sub> in the ore), is free from excessive breakdown, and produces a good yield of strong aggregates for plaster and concrete.

The use of this lightweight product, perlite, promises much to the rock products industry, machinery fabricators, and users of its end products. To date primary consumption has been largely in the fields of hardwall plaster, acoustical plaster, and lightweight insulating concrete for roof decks and walls. Perlite offers exceptional possibilities for extremely effective thermal insulation. Researchers and inventors are finding new and unexpected uses for this versatile material, and the great demand for perlite products that has already developed has made it an industry of considerable magnitude and significance.



JOE BALES

300 Yards a Day  
for 3½ Years...  
"I couldn't want  
a better screen."



LIKE many widely experienced men in the aggregates business, Joe Bales has used a number of different screens, but the one he is using now at the Bluff Road Sand and Gravel Company, Indianapolis, Indiana, is a Deister Vibrating Screen.

"In 3½ years of operation, we've never had any trouble with this Deister screen," says Mr. Bales.

"And the screen sure handles the load. To produce 300 yards a day, we often must get 1 yard a minute from this screen. I can say that it is really built . . . and really good. In fact, I couldn't want a better screen."

The Deister employed at Bluff

Road is a triple-deck 3'x8' unit, sizing 1½" L gravel, ¾" gravel, and ¼" concrete sand. This unit, like all Deister Vibrating Screens, has an exclusive, elliptical throw with vigorous, positive action for fast accurate sizing. It is ruggedly built, with simple, oil bath lubricated two-bearing construction for long, trouble-free service.

It is the kind of screen that operators like Joe Bales say will "put more profit in your business." Why not get all the facts on Deister Vibrating Screens for your operation? Just ask for a copy of Bulletin No. 50 which shows you how to specify the proper vibrating screen for your requirements.



# Tuffy Scrapers Rope

TRADE MARK ®



## Picks Up and Lays Down More Pay Dirt on All Types of Wheel Scrapers

"Two thirds fewer cuts due to drum crushing." "Wears out instead of breaking." "Gave 33-1/3 more service." "Half as much down time due to re-wiring." These are typical comments by users. Change over one scraper to Tuffy. Test its extra yardage handling ability and you'll change to Tuffy Scraper Rope on your whole fleet.

### Tuffy is Tailored to Take:

- Greater Drum Crushing Abuse
- Sharper Bends Over Small Sheaves
- Angle Pulls Thru Swivelled Sheaves
- Crawling On Guide Roll Flanges
- Heavy Line Pull . . . Rapid Line Speed
- Multiplied Shock of Load On Slack Line

### Tuffy—The Single Answer To All Scraper Rope Problems

For longer runs and lower costs, mount Tuffy reels on your scrapers. The name Tuffy, the diameter and the length—that's how simple it is to buy scraper rope for new yardage records. Remember, Tuffy is the name to remember.



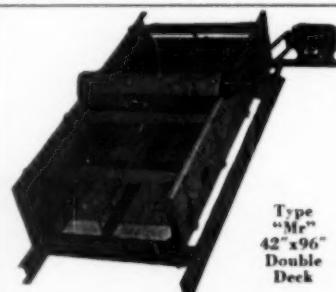
**union**  **Wire Rope corporation**

2156 Manchester  
Ave., K. C., Mo.  
Send Complete de-  
tails on Tuffy  
Scraper Rope.

FIRM NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_



**UNIVERSAL VIBRATING SCREEN CO.**

Type  
"M"  
42" x 96"  
Double  
Deck

### UNIVERSAL SCREENS

**WILL PAY FOR THEMSELVES IN  
YOUR SERVICE IN A SURPRISINGLY SHORT TIME.**

**THE BEST IN VIBRATING  
SCREENS AT THE LOWEST COST.**

Let us send you a copy of catalog  
No. 109—32 pages on Screens and  
Screening.

Why not write TODAY!

### Trends

(Continued from page 106)

on a "stand-by" basis for two to three weeks during the hottest part of the summer. The past summer, being one of the hottest on record, especially in the East, business in many cases slowed down to a trickle. One large ready-mixed concrete producer in New York had to stop pouring concrete during some of the hotter days and examples were numerous where highways were buckling under the extreme heat. Inasmuch as many producers, because of union requirements, have to give their employees an annual vacation, this idea of the mass vacation might be given consideration.

Several instances were found where infra-red electric heater units were in use for drying special products. This type of ray has certain penetrating powers and for some uses it is a cheaply installed, dustless, easily controlled drying system. However, the cost of operation per ton of material dried is high. These installations all involved the use of a slow-moving screw conveyor above which were clusters of the infra-red heater lamps, and as the material in the conveyor moved slowly along, it was dried. In two plants we saw the centrifugal filter in use.

### Concrete

Additives for concrete, each with its advocates, was a general theme of interest to ready-mixed concrete producers and all those who supply the basic materials from which concrete is made. Air-entrained concrete was accepted by all.

After attending 14 conventions during the past year, practically all of which devoted some floor time to papers and discussions relating to the modus operandi of making better concrete, we think the policy of one western producer may still point the way. He said: "If you want to make better concrete all you got to do is put some cement in it."

### Beneficiation

(Continued from page 117)

the trucking cost to the airport. The proportion of lost time caused by the Mobil Mill has been negligible to date. Pending detailed costs from a full season of operation, it is estimated that the mining and crushing-screening operations will cost 65¢ per cu. yd. for each and 10¢ per mile for trucking, a distance of 4 miles, making a total of \$1.70 per cu. yd. These estimates are believed to be ample.

The cost of aggregates loaded into the cars at Birds Hill was 80¢ for sand and \$1.40 for coarse aggregate. It is expected that these prices may be increased as much as 20 percent for 1950. With a present freight rate of \$2.51 per yard, the delivered cost for the 1949 season totaled \$3.90 per cu.

yd.; in addition there was the cost of unloading the cars at 40c per cu. yd., unless they can be unloaded direct to the batcher.

Before removing the plant, a stockpile will be processed for future construction. An investigation will be made to ascertain whether it is worth while to process aggregates for concrete block construction so that materials will be cheaply available for a future building program.

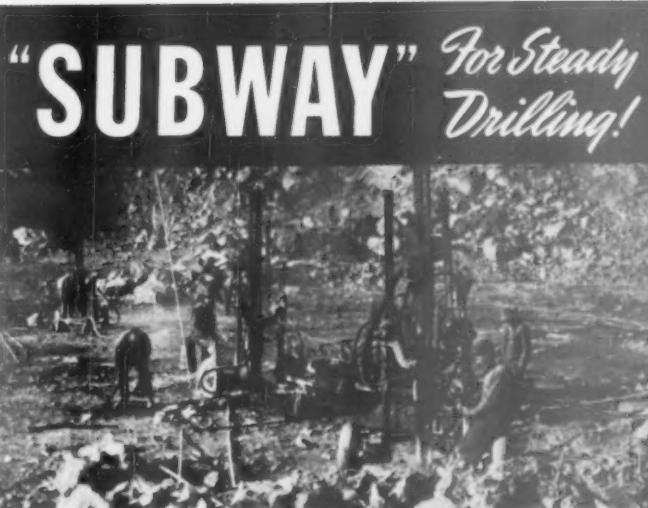
The heavy media process can be used to great advantage for the beneficiation of poor gravels, if the harmful material can be removed by specific gravity methods. It may be especially valuable in this age of high freight rates. The cost of the process, including royalty, is about equivalent in Manitoba to a truck haul of two miles.

#### **Application of the Process**

In order to decide whether the process can be used successfully on any project, the following should serve as a guide: The deleterious material must be lighter or heavier than the desired constituents of the gravel, but a large difference is not essential. A higher specific gravity of medium can be obtained by substituting ferrosilicon for part of the magnetite, and a difference of 0.1 in specific gravity is sufficient for separation. The materials in the deposit should be naturally proportioned in the correct sizes, or be capable of being made so by crushing and screening without too much cost. A source of minus-10 mesh sand, if required, must be assured either by natural deposits or by one of the treatments described.

Power can be obtained by substituting self-contained power units where necessary. Water may be a major problem. As explained, the process does not require much new water, and 30 g.p.m. would probably be ample. It does, however, require a large amount of circulating water for screening out the minus 10 mesh. A settlement area, where the water can drop its burden of clay and sand, is therefore essential. If the water table is close to the surface, there will be no difficulty, but if the water table is low, reservoirs may be made in clay, as in this project, or settlement tanks may be necessary. Circular tanks with a raking mechanism would be excellent, but rectangular tanks of fairly small area can be used if cleaned out periodically. The addition of lime or some other settling agent would get rid of colloidal clay quickly.

It is now recognized that materials in aggregate that are harmful to concrete also may be injurious to asphalt. This process should therefore have a considerable future in the gravel industry, particularly for concrete and asphalt road work since it is semi-portable, and also whenever cheaper or higher strength aggregates can be obtained by its use.



**WRAPPED DUCK  
CONSTRUCTION  
SIZES -  $\frac{1}{2}$ " to  $1\frac{1}{2}$ "**

A Goodall "Standard of Quality" hose, built to withstand the rough service involved in quarry drilling and handling. Red rubber cover is highly resistant to severe abrasive wear. *Balanced construction* assures equal durability for cover, carcass and tube. Result: longer service, with important savings in hose replacement costs.

*Contact Our Nearest Branch for Details and Prices*



**GOODALL RUBBER COMPANY**  
GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.  
Branches: Philadelphia • New York • Boston • Pittsburgh • Chicago • St. Paul • Los Angeles  
San Francisco • Seattle • Salt Lake City • Denver • Houston • Distributors in Other Principal Cities

## **MANGANESE STEEL CASTINGS**

for  
PULVERIZERS  
CRUSHERS  
ROLLS  
SCREENS



for  
SHOVELS  
DREDGES  
CRANES  
CONVEYORS

**The Frog, Switch & Mfg. Co.**

*Established 1881*

CARLISLE, PA.

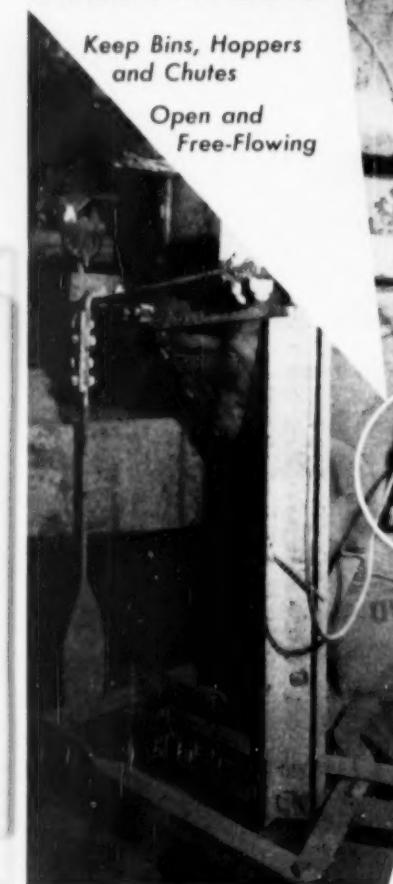
# SYNTRON

"Pulsating Magnet"

## ELECTRIC VIBRATORS

Keep Bins, Hoppers and Chutes

Open and Free-Flowing



### 3600 VIBRATIONS

per minute break down arching and plugging — eliminate pounding and poking.

Write for literature

**SYNTRON CO.**  
450 Lexington, Homer City, Pa.

## LONGER PRODUCING LIFE BUILT INTO FARREL-BACON CRUSHERS

Permanent strength and operating efficiency is engineered into these crushers at every vital point. Farrel-Bacon will provide industrial units or completely designed and equipped plants, including screens, elevators and conveyors. Also other types of mine, quarry, sand and gravel plant machinery. Write for complete information.

**FARREL-BACON**  
ANSONIA, CONNECTICUT



### Manufacturers' News

The B. F. Goodrich Co., Akron, Ohio, has announced the election of Raphael G. Jeter, general counsel, to the position of secretary and general counsel, succeeding Willis F. Avery, who has retired after more than 25 years of service with the company. Announcement has also been made that John L. Collyer, president of the company, has been made a Chevalier of the Legion of Honor by the French Republic, for services rendered to the Allied cause during the war and to French industry in its period of reconstruction.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has appointed Albert I. Edwards as basic industries machinery specialist for the mid-Atlantic region. William D. Busch, former crusher sales application engineer in the basic industries machinery department, has been named sales representative in the Youngstown, Ohio, district office. A. B. Frost has been named manager of the Boston office, which has been headed by W. F. Taylor as district office manager and manager of the New England region. Mr. Taylor will devote all his time to his duties as regional manager. Mr. Frost was manager of the New Haven district office, which position has been taken over by J. E. Smet, formerly representative in the Boston office. G. G. Fintak, assistant engineer at the West Allis Works, has been transferred to the Boston district office. G. H. Hoffman, formerly manager of the Knoxville office, has been named manager of the Birmingham district office, succeeding J. J. Greagan, who has retired after more than 25 years of service. H. C. Sells has been made manager at Knoxville, and I. K. Cox, who has been crushing, cement and mining sales representative in the New York district office, has been named to handle products of the crushing and cement division of the basic industries machinery department for the Empire region.

American Brake Shoe Co., New York, N. Y., has opened a sales office at 2620 Maury St., Houston, Texas. William C. George has been appointed sales engineer in this territory which comprises Oklahoma, Texas and Louisiana. Paul L. McCulloch, Jr., has been transferred to the Pittsburgh, Penn., district sales office as sales engineer for the American Manganese Steel and Electro-Alloys Divisions. He succeeds M. A. Zeller, who has resigned.

Pennsylvania Crusher Co., Philadelphia, Penn., announces that James E. Stine, chief engineer, has marked his 31st year with the company. He started as a draftsman in 1918 and later became chief draftsman, then five years later was made supervisor of the engineering department. He

was assistant chief engineer for 12 years before his appointment as chief engineer in 1940. Edwin H. Keiper, formerly chief design engineer, has been made chief service engineer. Announcement has also been made that Stanley B. Troyer, Crosby, Minn., has been appointed sales representative for Minnesota, the northern half of Wisconsin, and Michigan's upper peninsula. Leatherman & Mertz, Detroit, Mich., has been named sales representative for Detroit and the northern and eastern counties of Michigan's lower peninsula. The Swaney Co., Newtonville, Mass., will represent the company in Massachusetts, Connecticut, Rhode Island, Vermont, New Hampshire, and Maine, and the Wharton L. Peters Machinery Co., St. Louis, Mo., has been made sales representative for all of Missouri and the southern counties of Illinois and Indiana.

The Gene Olsen Corp., Adrian, Mich., announces that F. M. Cook, formerly vice-president of The Stearns

Machinery Co., Inc., Adrian, Mich., has become associated with the company. Mr. Cook had been with Stearns since 1941, starting as purchasing agent. Two years later he was made assistant sales manager, and in

1948 was promoted to vice-president and sales manager. He has had wide experience in the production and sale of concrete block machinery, and his knowledge of the problems involved in the manufacture of concrete masonry units was acquired during the time he owned and operated a block plant in northern Ohio.

Morse Chain Co., Division of Borg-Warner Corp., Chicago, Ill., announces that Robert G. Holmes has been appointed branch manager of the Chicago sales office. J. A. Shomer Co., Cleveland, Ohio, has been appointed distributor in the Cleveland area.

The Colorado Fuel & Iron Corp., Denver, Colo., has announced consolidation of the advertising offices. The director of advertising and the western division advertising manager will continue to be located in Denver, Colo. The advertising department of the Wickwire Spencer Steel Division, formerly in New York, will now be known as the eastern division advertising department and will also be located in the Denver offices, with Robert W. Brown as eastern division advertising manager.

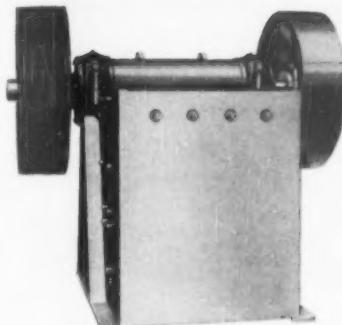
Caterpillar Tractor Co., Peoria, Ill., announces that William Kusz, formerly supervisor of industrial advertising at Peoria, has been named supervisor of cooperative advertising to succeed K. M. Emery who has resigned to join



F. M. Cook

# ROGERS

**GREATER CAPACITY  
BY STAGED REDUCTION**



*Superior  
Long Service*  
**JAW  
CRUSHERS**

- 6 Primary Sizes
- 12 Secondary Sizes
- Sizes up to 32 x 40 in.

Rogers Jaw Crushers give you superior action and greater capacity from their extra long jaws. Greatly oversize bearings and shaft prevent breakdown and assure years of wear.



Rogers equipment can be depended upon to give you better rock products at less cost. Write today for illustrated booklet with specifications on Rogers Jaw Crushers.

## ROGERS IRON WORKS CO.



JOIN  
THE  
11,895  
PRODUCERS  
WHO  
REGULARLY  
READ  
ROCK  
PRODUCTS

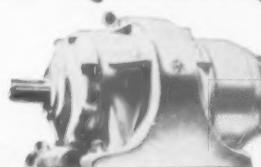
## U. S. SYNCROGEAR

the motor  
with  
multiplied  
power

Geared to the needs  
of Rock Product plants

Ask for Bulletin  
**U. S. ELECTRICAL MOTORS INC.**

Pacific Plant  
Los Angeles 54, Calif.



Atlantic Plant  
Milford, Conn.

only a  
**1-Man  
JOB**  
WITH A  
**SAUERMAN  
Excavator**

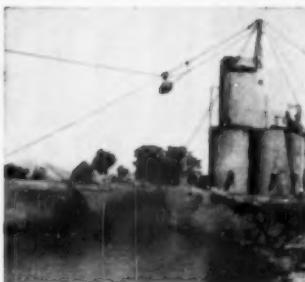
Lower costs are the rule when Sauerman Scrapers and Slackline Cableways are used in sand and gravel excavation, stockpiling and other material-handling jobs where the long reach of these machines can be employed to advantage.

Digging, hauling and automatic dumping of any bulk material become one continuous operation, entirely controlled by one operator. First cost is low, upkeep is simple. Wide range of handling capacities and operating spans.

Write for Catalog

**SAUERMAN BROS., INC.**

530 S. Clinton St. Chicago 7, Illinois



Sauerman Slackline Cableway pictured above digs gravel from deposit deep under water and delivers to screens on top of silo bins. One man's labor and a moderate expenditure of power moves 140 cu. yd. an hour.



Here is a small Sauerman Power Drag Scraper delivering gravel to a hopper that feeds to a crusher. The scraper, controlled by one man from a central operating station as shown in the picture, swings in a wide arc to dig a large, deep pit.



Old Timer . . .  
*Streamliner*

**BIT PERFORMANCE ADVANCES, TOO!**

**TODAY it's ROK-BIT**

Faster drilling speeds and better chip clearance are the result of Rok Bits advanced design. Crown carbides increase cutting speeds. Self-clearing chip channels keep this bit from working in its own cuttings. Check your present drill bit performance against Rok Bits, if you are not already using them . . . and see. Write for details of trial offer and Rok-Bits field-tested 5-way betterment. Rock Bit Sales & Service Co., 2514 E. Cumberland Street, Philadelphia 25, Pa., Branch—Asheville, N. C.

A complete line of pneumatic tool accessories.



*Better your footage with*

**ROK-BITS**

**CROWN DESIGNED CARBIDES**

PAT. PEND.

Hosler Advertising, Inc., Peoria, Wendell J. Farischon, formerly news editor of *News Service*, has been named to succeed Mr. Kusz, and Jerry Cook, formerly news writer, has been made news editor.

Air Reduction Co., Inc., New York, N. Y., announces that the corporate structure of the company has been changed. It involves the liquidation of all wholly owned domestic subsidiaries into divisions which will operate in the same manner and with the same organizations as the companies they supersede. No changes in personnel are involved. This change does not include foreign subsidiary companies.

American Wheelabrator & Equipment Corp., Mishawaka, Ind., has appointed Robert T. Pring as technical director of the dust and fume division. He was formerly director of the industrial hygiene department of Kennecott Copper Corp.

Towmotor Corp., Cleveland, Ohio, has announced opening of a new factory sales and service branch in Oakland, Calif. Gordon Winters, formerly in sales supervision work in Cleveland, has been placed in charge of the branch office.

Allied Steel Products, Inc., Cleveland, Ohio, has announced the appointment of L. R. Edminster as division sales manager on the Pacific Coast, and Wade V. Kern as division sales manager of the territory east of the Mississippi River. Frank L. Shoemaker, Seattle, Wash., has been named sales representative for Washington and Oregon; William Barron, San Francisco, Calif., for northern California; Don Page, Lansing, Mich., for Ohio and Michigan; and George D. Heath Co., Kansas City, Mo., for Nebraska, Kansas, Iowa, Missouri and the southern half of Illinois.

The Jaeger Machine Co., Columbus, Ohio, has appointed H. A. Kindler as district manager in the area comprising Illinois, Iowa, Missouri, Nebraska and Kansas. Dale D. Murray, western representative in San Francisco, has been named to succeed Mr. Kindler as manager of the air compressor division.

United States Rubber Co., New York, N. Y., has announced the appointment of Herbert G. Kieswetter as assistant general manager of the mechanical goods division. He was formerly vice-president and assistant general manager of United States Rubber Export Co., Ltd.

Mack Trucks, Inc., New York, N. Y., announces that J. M. Donahue, vice-president of Mack-International Motor Truck Corp., has been named manager of the Atlantic division with headquarters in Philadelphia, Penn. He will cover the states of Pennsylvania, Delaware, Maryland and the District of Columbia.

General Electric Co., Schenectady, N. Y., announces that the apparatus agency division of the industrial divisions has been replaced by a newly-organized agency and distributor division, with George L. Irvine as manager and R. D. Moore as assistant manager.

Marion Power Shovel Co., Marion, Ohio, has announced the appointment of Merle V. Lashey as assistant chief engineer in charge of large shovel design, succeeding the late Glenn B. Heffelfinger. Mr. Lashey has been associated with the company for 31 years.

The Falk Corp., Milwaukee, Wis., has appointed Arthur L. Larson as assistant to the sales manager. He has also been made manager of the sales inquiries division. William J. Urban, formerly special representative, has been appointed manager of coupling sales. Don K. Lambert has been named manager of distributor sales, and Roland E. Govan has been placed in charge of sales promotion, assisted by Eugene H. Millmann and A. H. Kelley. Nile E. Sweet, special representative, distributor division, has been assigned to Detroit for special training. Harold C. Fleischer has been transferred to the New York district office to handle inquiries and orders, and Elliot G. Heuser has been assigned to the Wisconsin sales division headed by L. H. Billing, sales representative.

The Dorr Co., New York, N. Y., has moved its main office from New York, N. Y., to Barry Place, Stamford, Conn.

Lippmann Engineering Works, Milwaukee, Wis., announces the appointment of Loggers & Contractors Machinery Co., Portland, Ore., with branches at Eugene and Klamath Falls, as distributors in the state of Oregon.

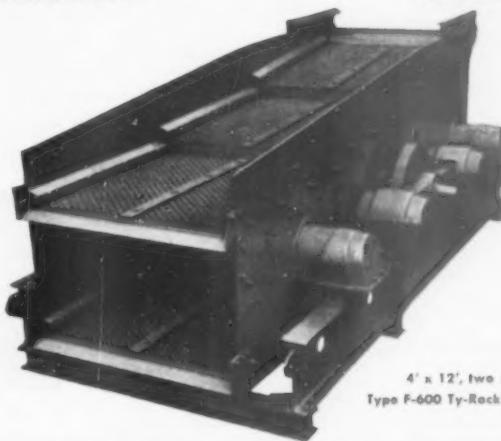
Joy Mfg. Co., Pittsburgh, Penn., has appointed R. G. Gehlsen as sales manager and H. B. Zeppenfeld as manager of industrial sales of the mines equipment division.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has begun construction of a new \$1,000,000 steel service plant and office building on Spring Grove Ave. at Adelaide St. in Cincinnati, Ohio. The new plant is expected to be completed by Fall.

Federal Motor Truck Co., Detroit, Mich., planned a new sales and advertising program for 1950 at a recent meeting of sales executives which will carry advertising in 42 national and regional trade publications, including ROCK PRODUCTS. Present at the meeting were Lewis I. Seaver, advertising director, and H. J. Hamernik, A. R. Winberg and W. L. Hayes, assistant general sales managers.

The Dow Chemical Co., Midland, Mich., has announced the appointment of Reliance Steel Co., Los Angeles, Calif., to warehouse magnesium wrought products.

## YOU CAN DEPEND ON TY-ROCK SCREENS BALANCED RUGGED



4' x 12', two surface  
Type F-600 Ty-Rock Screen

### THE W. S. TYLER COMPANY CLEVELAND 14, OHIO

Manufacturers of Woven Wire Screens and Screening Machinery



### PYRASTEEL

PYRASTEEL's amazing record of service is demonstrated by the old type Kiln Ring, shown at left, which withstood high temperatures in a large cement plant in Dallas, Texas, for over 14 years.

This solid ring casting, recently scrapped, weighed 4200 lbs. Today's segmented type Kiln End of the same size would save at least one ton in weight, and about \$1000 in cost.



Over 70% of the annual cement output is produced in plants that now are using either or both of our alloys, PYRASTEEL and EVANSTEEL.

Durable PYRASTEEL Kiln Ends enable modern cement plants to avoid costly burnouts and shutdowns.

PYRASTEEL is economically adapted for many other high heat applications, including conveyor screws, clinker coolers, feed pipes, and drag chains.

Write for PYRASTEEL Bulletin

### Chicago Steel Foundry Co.

Kedzie Ave. and 37th St., Chicago 32, Ill.

In the past 20 years over 1000 PYRASTEEL Kiln Ends have been installed. Some have lasted for 15 years without a failure.

Makers of Alloy Steel  
for Over 35 Years

# THE WIRE ROPE

## You Can Depend on —



**HERCULES (Red-Strand)** Wire Rope always lives up to its widespread reputation for outstanding performance . . . even under the severest conditions. For safe and economical operation, specify **HERCULES** ("Red-Strand")

Made only by —

### A. LESCHEN & SONS ROPE CO.

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Est. 1857  
New York 6 • Chicago 7 • Birmingham 6  
Denver 2 • Houston 3 • Los Angeles 21  
San Francisco 7 • Portland 9 • Seattle 4



Jos. G. Broz

Cambridge Wire Cloth Co., Baltimore, Md., announces that R. D. Travars Co., Canadian representatives, has moved its offices to 117 Charlton Ave., in West Hamilton, Ontario.

**Easton Car & Construction Co.** Easton, Penn., has elected George W. McGrath as a director of the company. Mr. McGrath, who is a partner of McGrath, Doyle & Phair, C.P.A., New York, N. Y., has served in an advisory capacity for several years.

**Nordberg Mfg. Co.**, Milwaukee, Wis., has announced the appointment of Jos. G. Broz as sales manager of the four-cycle diesel engine department. Mr. Broz was vice-president in charge of sales of Busch-Sulzer Diesel Engine Co., St. Louis, Mo., at the time that company was purchased by Nordberg in 1946. Until his present appointment Mr. Broz had been surveying South American market possibilities and establishing field sales and service organizations there. H. M. Cahill has been named to assist Mr. Broz in directing the sales activities of the four-cycle diesel engine department.

**Besser Mfg. Co.**, Alpena, Mich., has named Jonathan John Buzzell as publicity counsel for the company. Mr. Buzzell will devote his entire time to the further advancement of the Besser Cooperative Advertising Service which he helped plan and create. Duane D. Bryan, who has been associate advertising manager for the past two and one-half years, succeeds Mr. Buzzell as advertising manager. In addition to handling the general advertising, Mr. Bryan will continue his work in servicing Vibrapac operators with Cooperative Advertising materials and in personal contacts.

**Lincoln Electric Co.**, Cleveland, Ohio, has distributed over \$3,000,000 in incentive pay to workers. These payments have been made to workers for 16 consecutive years.

**Cummins Engine Co., Inc.**, Columbus, Ind., announces that factory and dealer service representatives from more than 200 sales and service outlets for Cummins diesel engines have completed a special school at the Columbus, Ind., plant. The sessions featured instruction on the new DD fuel pump and the new V-12 diesels, the NVH-1200 and NVHS-1200 engines. H. H. Hall, general service manager, was in charge of the program. He was assisted by P. E. Daugherty, western service manager; D. B. Davis, eastern service manager; L. O. Edwards, serv-

ice training supervisor; and John Van Norman, Jr., instructor.

**Link-Belt Co.**, Chicago, Ill., announces that on May 1, Richard E. Whinney, assistant general manager at the Dodge plant in Indianapolis, has been made assistant general manager at the Ewart plant, and that Raymond S. Wood, general manager at the Minneapolis plant, has succeeded Mr. Whinney as assistant general manager at the Dodge plant. Leslie J. Carson, formerly chief engineer at San Francisco and at present chief engineer at the Caldwell plant in Chicago, has been appointed general manager of the Minneapolis plant and the north central sales division. William P. Ridsdale, who has been chief engineer at Dallas and Houston since 1946, has returned to Chicago as chief engineer of the Caldwell plant.

**Federal Motor Truck Co.**, Detroit, Mich., has announced the appointment of C. H. Cowan as factory sales representative in Wisconsin and Upper Michigan.

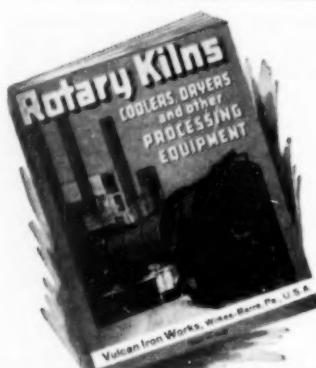
**Hyster Co.**, Portland, Ore., has appointed the A. & W. Engineering Co., Miami, Fla., as distributor in the southern part of Florida. Wren Bros., Charlotte, N. C., has been named representative covering all of South Carolina, the southern part of North Carolina and most of Georgia; and King & Kringel Machinery Corp., Denver, Colo., will represent the company in Colorado, most of Wyoming and the western part of Nebraska.

**Chain Belt Co.**, Milwaukee, Wis., announces the appointment of Robert R. Horton as Midwest sales representative for the construction machinery division.

**Welding Research Council**, New York, N. Y., announces that Dr. C. A. Adams has been elected honorary chairman of the Council. H. C. Boardman, formerly vice-chairman, has been named chairman, and Dr. A. B. Kinzel has been made vice-chairman.

**Hewitt-Robins, Inc.**, New York, N. Y., has appointed Austin Goodyear as assistant to B. T. Moffatt, vice-president in charge of sales. C. A. Thompson has been named Charleston district sales manager, and C. W. Brooks, formerly representative in northeastern Pennsylvania, has been transferred to the Virginia-North Carolina sales territory for the Hewitt Rubber and Robins Conveyors divisions.

**Nordberg Mfg. Co.**, Milwaukee, Wis., has announced the following distributor appointments for the new 4FS-1 diesel engine: Al-Pac Engine & Equipment Co., Seattle, Wash.; Atlantic Engine Supply, Inc., Boston, Mass.; Bolinders Co., Inc., New York, N. Y.; H. G. McKinney & Co., Wilmington, Calif.; Northwest Distributors, Ltd., Vancouver, B. C., Canada, and J. N. Vernam Co., Miami, Fla.



**THIS BOOK TELLS**  
why **VULCAN** Rotary Kilns, Coolers, Dryers, Retorts, etc. give more years of trouble-free service — are more economical in the long run. Its 28 large pages are fully illustrated and packed with information regarding modern designs and constructional features.

Ask for Bulletin 442-R

**Vulcan Iron Works**  
WILKES-BARRE, PA., U. S. A.

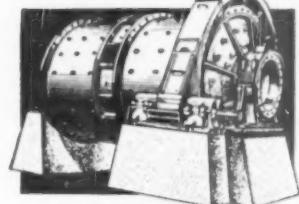


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WEIGHTOMETER gives a continuous, automatic, and accurate weight record of materials in transit at an extremely low operating cost. All producers of bulk materials handled by belt conveyors need this dependable check on production figures supplied by MERRICK WEIGHTOMETER.

**Merrick Scale Mfg. Co.**  
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### WITH MARCY C-P-D Rod Mills

On Government dam projects and in industrial sand and gravel plants, the New MARCY Center Peripheral Discharge Rod Mills are producing Specification Sands with fineness modulus variations of 0.10.

Other advantages include gradation flexibility, cubical particle shape, and continuity of operation. Write for list of MARCY C-P-D installations on specification sands and full information.

**Mine & Smelter  
SUPPLY COMPANY**  
DENVER, SALT LAKE CITY, EL PASO, 177 BROAD, NEW YORK

### Financial

#### RECENT DIVIDENDS

Alpha Portland Cement Co.	\$00.40	Mar. 10
Calaveras Cement, 7% pf.		
Ac.	.69.25	Jan. 31
Calaveras Cement, pr. pf.	2.50	Jan. 31
Calif. Portland Cement	1.80	Jan. 25
Canada Crushed Stone,		
Ltd., E.	.20	Jan. 3
Coronet Phosphate Co.	.50	Jan. 3
Gypsum Lime & Alab. Can.	.35	Mar. 1
Gypsum Lime & Alab. Can.	.35	June 1
Gypsum Lime & Alab. Can.	.35	Sept. 1
Gypsum Lime & Alab. Can.	.35	Dec. 1
National Gypsum Co.	.25	Mar. 1
New England Lime Co.,		
pf. clears arrears	6.00	Jan. 3
Northwestern States Port-		
land Cement Co.	.50	April 1
Oliver Corp., 4 1/2% pf.	1.12 1/2	Jan. 31
Pac. Coast Aggregates, Inc.		
Penn Glass Sand Corp.	1.12 1/2	Jan. 16
Permanente Cement	.45	Jan. 1
Riverside Cement Co.,	.50	Jan. 31
E. pf.		
Riverside Cement Co.,	1.25	Feb. 1
CL. A Ac.	.50	Feb. 1
Standard Pavement & Ma-		
terials Ltd.	.50	Mar. 1
Standard Pavement & Ma-		
terials Ltd., pt. pf. cum.	.31 1/4	Mar. 1
Standard Pavement & Ma-		
terials Ltd., pt. pf. N. cum.	.31 1/4	Mar. 1
Standard Pavement & Ma-		
terials Ltd., pt. pf. part	.50	Mar. 1
Standard Pavement & Ma-		
terials Ltd., E.	.50	Jan. 3
Warner Co.	.25	Jan. 16

NATIONAL GYPSUM CO., Buffalo, N. Y., president, M. H. Baker, has estimated that sales in 1949 will be close to \$58,000,000 compared with a \$68,125,235 record volume last year. Net income for 1949 is estimated at about \$5,400,000 against \$7,997,976 in 1948. For the nine months to September 30, 1949, net sales were \$42,835,748, net profit \$4,081,146, and earnings per common share were \$1.79. For the same period in 1948 net sales were \$49,852,860, net profit was \$5,545,548, and earnings per common share were \$2.48.

BASIC REFRactories, INC., Cleveland, Ohio, has reported for the three months ended September 30 a net profit of \$89,685 for 1949 as contrasted to \$155,520 for the same period in 1948. Share earnings for this period were 26 cents in 1949 and 44 cents in 1948. For the nine months ended September 30 share earnings for 1949 were \$1.33; for 1948, \$1.12. Net profits for the nine months period in 1949 were \$465,407 as contrasted to \$393,645 for the same period in 1948.

PACIFIC PORTLAND CEMENT CO., San Francisco, Calif., has declared a \$2.75 dividend on old shares. After issuance of 232,296 new shares there will be 404,120 shares outstanding. Stockholders of the company recently approved an amendment, to the articles of incorporation increasing authorized common stock, \$10 par value, from 100,000 to 1 million shares.

PACIFIC COAST AGGREGATES, INC., San Francisco, Calif., has reported, for the three months ended September 30, 1949, a net profit of \$131,664 and 16 cents net per common share. For the same period in 1948 net profit was \$167,554 and net profit per common share was 27 cents. For the nine months ended September 30, 1949, net profit per common share was 27 cents. Net profit was \$246,759 as contrasted



### MANGANAL

(T. M. Reg. U. S. Pat. Off.)  
11% to 13 1/2% Manganese-  
Nickel Steel

## HOT ROLLED PLATES

### Rebuild Worn Parts ECONOMICALLY!

Workhardens to 550 Brinell. Can be punched and sheared, formed hot or cold. Tensile strength up to 150,000 p.s.i.

### Pr-r-ractical Applications



Name of Nearest Distributor  
on Request

FREE! Write for Copy of "Manganal  
Marketer" Today!

### STULZ-SICKLES CO.

SOLE PRODUCERS

91 N. J. Railroad Ave., Newark 5, N. J.

# STEEL

**Every Kind  
Quick Delivery**  
**Plates, Structural,  
Bars, Sheets, Tubes, etc.**  
**Carbon, Alloy, Stainless  
Steels, Babbitt Metal.**

## RYERSON

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles, San Francisco

to net per common share of 82 cents and net profit of \$501,776 for the same period.

PENNSYLVANIA GLASS SAND CORP., Lewistown, Penn., has issued the following report of consolidated earnings for the nine months to September 30:

	1949	1948
Net before taxes	\$1,346,179	\$1,472,954
Income tax	540,295	592,443
Net profit	805,884	880,511
Earn., pf'd. share	\$26.09	\$28.40
Earn., com. share	2.14	2.37
Number of pf'd. shares	31,000	31,000
Number of com. shares	321,860	321,860

CALAVERAS CEMENT CO., San Francisco, Calif., 5 percent prior preference stock will be redeemable at \$50 a share plus accumulated and unpaid dividends up to March 31, the firm has announced. This accumulation will amount to 62.5¢. The prior preference stock also is convertible into Calaveras common shares at the rate of six shares of common for one share of prior preference.

CELOTEX CORP., Chicago, Ill., has reported a net profit, to October 31, of \$1,950,000 for 1949 as contrasted to \$6,785,189 for the same period in 1948. Earnings for the year to October 31, 1949, on common shares was \$1.86 contrasted to \$7.20 for the same period of 1948.

SPOKANE PORTLAND CEMENT CO., Spokane, Wash., net profit for the nine months to September 31, 1949 was \$100,543. Earnings per share for this period were \$3.59. For the year

to December 31, 1948 net profit was \$105,891; earnings per share were \$2.78.

CORONET PHOSPHATE CO., New York, N. Y., has declared a total of \$10 in dividends for 1949 compared with \$8 in 1948.

ECONOMY BLOCK CO., Wauwatosa, Wis., has increased its stock from 1,000 to 1,500 shares. Par value of the stock is \$100.

MARQUETTE CEMENT MANUFACTURING CO., Chicago, Ill., financial statement for the 12-month period ended September 30 is as follows:

	1949	1948
Net sales	\$18,673,576	\$18,447,552
Other revenue	1,379,222	1,245,835
Total	20,052,798	19,693,387
Costs of sales	13,110,224	13,279,826
Selling, etc., exp.	2,363,858	2,430,994
Other expenses	289,400	242,338
Net earnings	4,289,515	3,740,228
Int. and land rent	151,139	154,639
Income taxes	1,628,987	1,360,377
Net profit	2,560,430	2,221,872
Earn., pf'd. share	\$8.26	\$67.35
Earn., com. share	7.22	12.88
Number of pf'd. shrs.	65,582	33,041
Number of com. shrs.	320,000	157,308

PENNSYLVANIA-DIXIE CEMENT CORP., New York, N. Y., earnings for the three months ended September 30 are:

	1949	1948
Net sales	\$5,690,030	\$5,615,168
Costs and expenses	3,840,061	3,621,167
Deprec. and deplet.	210,978	162,307
Operating profit	1,229,891	1,595,694
Other income, net	20,397	13,710
Total income	1,250,288	1,609,404
Federal income tax	490,340	531,716
Net profit	860,348	998,688
Earn., com. share	\$1.34	\$1.89
Number of com. shares	602,136	525,986



## HAMMOND Multi-Wall BAGS

SEWN • PASTED • OPEN MOUTH • VALVE STYLE

... take a lot of punishment in  
delivering your products safely and  
dependably... without losing their  
attractive appearance. They're Strong,  
Weather-proof, Economical!

Write for quotation on your needs!



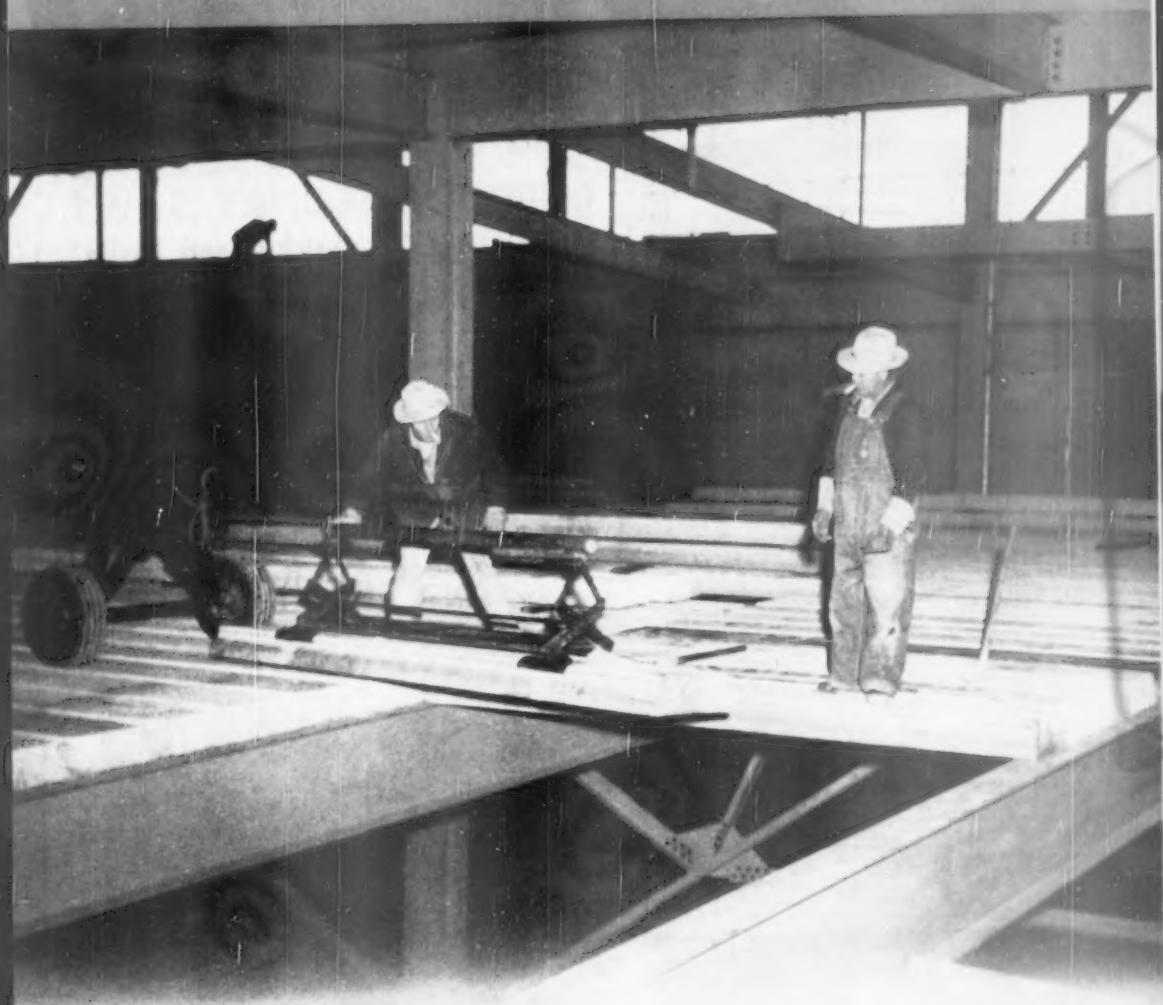
**HAMMOND BAG & PAPER CO.**

GENERAL OFFICES: WELLSBURG, W. VA.

Plants in Wellsburg, W. Va., and Pine Bluff, Ark.

# CONCRETE PRODUCTS

CONCRETE UNITS · READY-MIXED CONCRETE



Precast channel floor system being used in construction of Hollywood Park grandstand

A SECTION OF  
ROCK PRODUCTS



**SOLD DIRECT**  
from Factory to User

**PACKED WITH 1950 FEATURES**

**DUSTLESS CUTTING WITH MODEL HD**

The outstanding Self-Contained Circulating Water System on the 1949 Model HD makes possible Completely DUSTLESS Cutting. Yes, completely DUSTLESS cutting for intricate jobs in confined areas. When dust is no problem merely turn the pump valve for dry cutting. No, you don't have to disconnect the pump on the Model HD Clipper to cut dry for it is to eliminate such time consuming adjustments.



**BLADE PRESSURE EQUALIZER**

That smooth, sensitive cutting action on every Clipper is a result of another exclusive Clipper feature, the Pressure Equalizer Spring with its Automatic Action.

**ADJUST-A-CUT CONTROL**

Clipper's exclusive "Adjust-A-Cut" Control—just pull the knob to instantly lower or raise the cutting head for materials of varying sizes. A "One-Man" operation!

**SNAP-ON BLADE COVER**

A Clipper feature that lets you cut wet—with out getting wet! An outstanding safety feature for both wet and dry cutting operations.



*Yes...*

**CLIPPER MASONRY SAWS**  
**Make Any Cut Quickly and Easily!**

Yes, you can slice through the hardest materials in seconds with the 1949 Clipper Masonry Saws. Smoother, faster cutting action than ever before. You'll find Clipper's the Genuine answer to any masonry cutting problem. Contractors agree on the New wet or dry cutting Model HD for the 100% Answer to ALL masonry problems. Actually the HD is Two Saws In One—it will meet your DUSTLESS cutting requirements in confined areas and will cut dry for outside operations. Every Clipper Masonry Saw is GUARANTEED, "To provide the Fastest Cut . . . at the Lowest Cost . . . with the Greatest Ease . . . Any Time . . . Any Where!"

**Only *Clipper* Has NINE Models  
To Choose from! . . .**

Not ONE Model—Not TWO Models . . .

But NINE separate and distinct Clipper Saws for you to choose from. Each completely different in price, in size, in performance. Select the Clipper Model that EXACTLY SUITS YOUR particular needs!



Cut DRY—or cut WET . . .

Cut with ABRASIVE Blades—or with DIAMOND Blades . . .

In the more than 50 standard and special CLIPPER Blade specifications you will find THE EXACT SUPERIOR BLADE to cut YOUR materials AT THE EXACT SPEED YOU require!



**MANUFACTURING COMPANY**  
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Send TODAY information on the FREE TRIAL offer and literature and prices on the 1950 Clipper Masonry Saws.

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# INDUSTRY NEWS

## Conducts Concrete School

THE Wabash Valley Ready Mixed Concrete Association recently sponsored a two-day school which was attended by sixty-eight representatives, men who actually mix the concrete, from 59 ready-mix concrete plants in Illinois, Michigan, Wisconsin, Kentucky, and Indiana. Sessions were conducted at Rose Polytechnic Institute, Terre Haute, Ind., by Prof. R. E. Hutchinsons and Dr. R. E. Wilkerson.

After the motion picture, "The Drama of Portland Cement" was shown, the fundamentals of quality concrete, the effect of variation in sand-gravel content on workability and strength, and the effect of water on strength were discussed. There were talks on curing compounds and admixtures. The sessions closed with an afternoon in a testing laboratory.

## Automatic Continuous Mixer for Block Machine

AT A CONCRETE PRODUCTS PLANT in New York, the mixing operation is controlled by means of a push button located on the block machine. Through this device the operator can stop the mixer in the event of a stoppage of the block machine. This automatically turns off the aggregate and water feeds. A reset button is located at the same point, providing a means for starting the mixer and, through the use of a solenoid control valve, starts the water flowing at set rate.

In the set-up illustrated, a 10-ft. flat conveyor transports the material from the mixer to a hopper over the

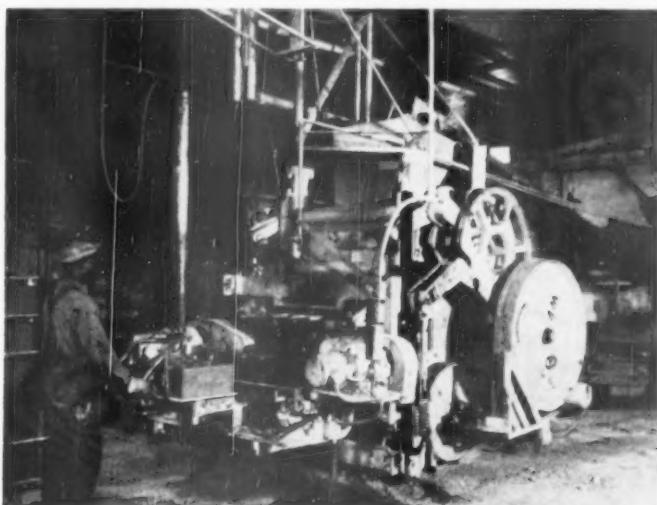
block machine. The automatic Stedile continuous mixer was developed and installed by The Kent Machine Co., Cuyahoga Falls, Ohio.

## Concrete Pavement Design

A REPORT recently issued by the American Road Builders' Association Committee on Concrete Pavement Design presents the trends in concrete pavement practices of the 48 state highway departments and the District of Columbia. This 122-page booklet, A.R.B.A. Technical Bulletin No. 163, has been compiled with the assistance of representatives from each of the highway departments and covers sub-grade soil practices, concrete materials, proportioning, placing, finishing and curing, as well as structural features of concrete pavements. The booklet also contains comments by committee members on the trends revealed by the tabulated results.

Members of the committee were A. T. Goldbeck, engineering director, National Crushed Stone Association, Washington, D. C., chairman; T. J. Kauer, director of highways, Ohio Department of Highways, Columbus, Ohio; Tilton E. Shelburne, director of research, Highway Research Council, University of Virginia, Charlottesville, Va.; E. W. Bauman, secretary, National Slag Association, Washington, D. C.; and H. F. Clemmer, engineer of materials, District of Columbia.

ADRIAN CEMENT BLOCK FACTORY, Adrian, Minn., has been leased to John Krieps by K. J. Whelan.



Continuous mixer controlled from block machine. Mixer, right, discharges into short conveyor for transport to hopper over block machine.

## Concrete Association Formed

THE READY-MIXED CONCRETE ASSOCIATION OF WISCONSIN, INC., a non-stock, non-profit corporation for furthering the welfare of the industry, has been formed with main offices in Manitowoc. Twenty-three firms have affiliated as charter members. According to the articles of incorporation, the purposes of the corporation are "to expand and preserve the markets for ready-mixed concrete through advertising and dissemination of information to the public . . . and to conduct investigations, studies and research and to compile factual data and gather information and knowledge which will be useful and valuable to the ready-mixed concrete industry in improving the efficiency of its operations . . ."

BUILDERS CO., Madison, Wis., is producing concrete block at the rate of 5000 standard units per day, with five men operating the plant. The firm crushes its own gravel and handles the materials on a completely mechanized conveyor system. Bids will be taken soon for erection of a new office to adjoin the present block plant.

CEMENT PRODUCTS CO., INC., Cumberland, Md., will soon begin construction of a new batching plant for ready-mixed concrete, according to Charles L. Nestor, president. The new plant, expected to cost \$10,000, will consist of a series of 20- x 26-ft. steel bins furnished by the Butler Bin Co.

THOMPSON CONCRETE PRODUCTS CO., INC., Kenosha, Wis., has been formed to deal in concrete products, building materials and fuels. George Nelson and Carl R. Thompson are the owners.

WILLIAM M. HAITH, Beatrice, Neb., has obtained a permit to construct a ready-mixed concrete plant at an estimated cost of \$10,000. It is expected to be in operation by July 15. Mr. Haith also has acquired a gravel plant to furnish aggregate for the concrete operation.

RUSS CONCRETE CO., Buckhannon, W. Va., has opened a ready-mixed concrete plant at a cost of \$20,000. Members of the company are Russell R. Phillips, Mrs. Phillips, Fred Rismisell, Sr. and Fred Rismisell, Jr.

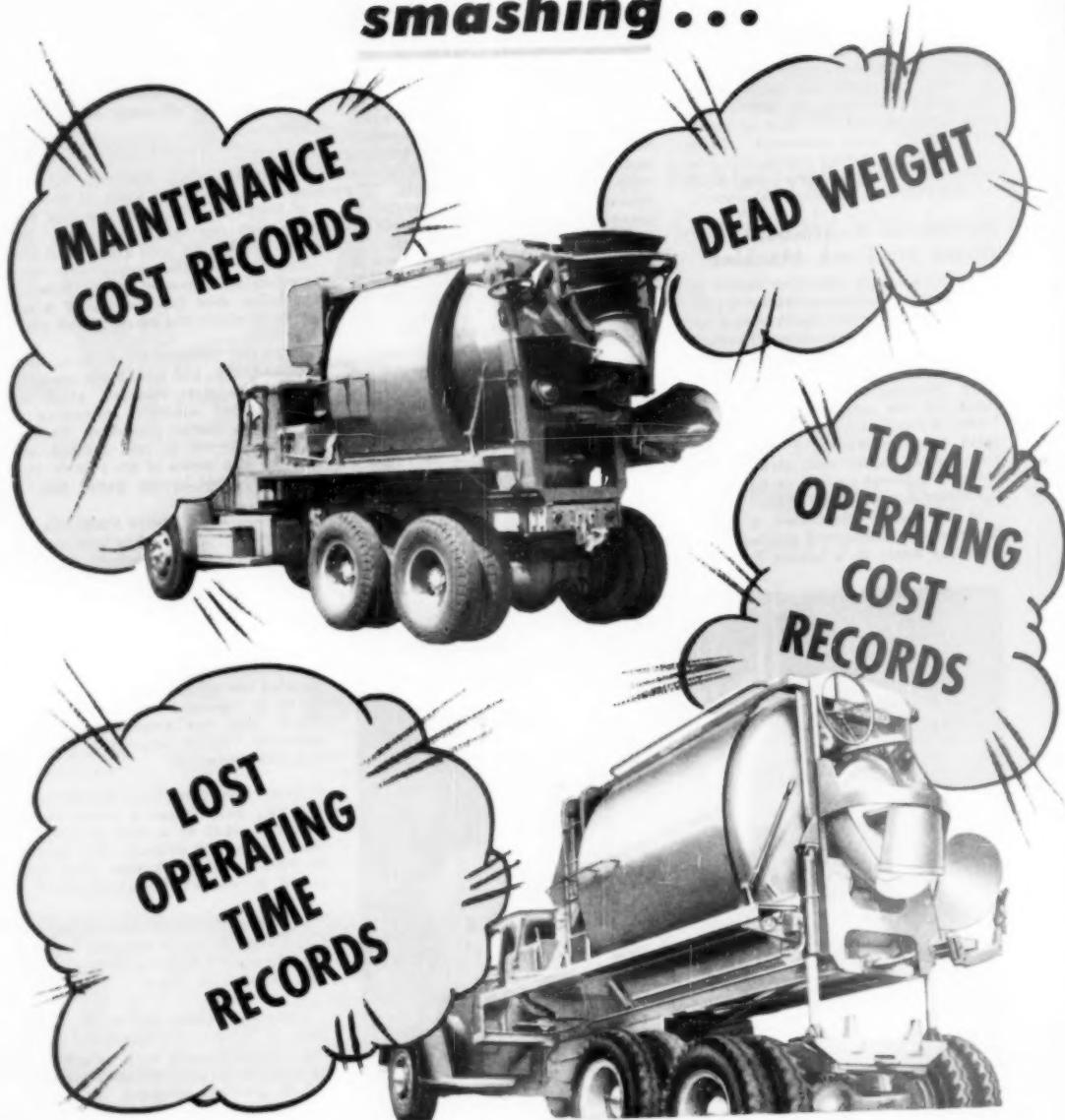
SOUTHEASTERN CONCRETE PRODUCTS CO., Cayce, S. C., is erecting a plant near Fairmont, S. C. for the manufacture of concrete tile.

LEFLER CONCRETE BLOCK CO., Charlotte, N. C., recently completed grading a large storage area adjacent to its plant to be used for open-air storing of concrete products. A modern drainage system also was installed in the area.



# FOLLOW

## MOTO-MIXERS to greater profits by smashing...



# the LEADER

## CHAIN BELT **REX** MOTO-MIXERS COMPANY



WITH A LINE OF LOWEST WEIGHT STANDARD MACHINES ON THE MARKET . . . as much as 2000 pounds lighter in some models. WITH THE FLEXIBLE CHAIN DRUM DRIVE.



TO DESIGN, PERFECT AND PRODUCE A COMPLETE TRANSMISSION FOR EXCLUSIVE TRUCK MIXER USE. First with lowest weight transmission—FIRST to use clutches running in oil.



WITH SINGLE-LEVER OPERATED MACHINES. FIRST to eliminate gear shifting in reversing direction of drum rotation or mixing operation.



WITH FOOLPROOF, POPPET-TYPE, NON-BY-PASS WATER CONTROL VALVE.



TO USE BOLTED-IN REMOVABLE MIXING BLADES. FIRST to use Man-Ten steel in drum and blades for longer life and greater resistance to abrasion.



WITH VISIBLE "DAYLIGHT" MIXING. Complete batch can be easily inspected in charging hopper during mixing.



TO USE ROLLER BEARINGS MOUNTED IN BALL-AND-SOCKET FOR FRONT DRUM MOUNTING . . . compensating for "twists" as truck chassis weaves.



TO USE A "SWING-AWAY" DISCHARGE CHUTE. FIRST to supply 8 standard spouting ranges.



TO USE "LOCOMOTIVE-TYPE" DRUM TRACK DESIGNED with track shrunk onto lugs on the drum. FIRST to eliminate welded drum tracks . . . to eliminate track cracking and breaking away.



TO RIGIDLY ATTACH CHARGING HOPPER AND DISCHARGE DOOR TO DRUM on Hi-Discharge Machines to prevent destructive scrubbing between these units. FIRST to use totally enclosed seal on hopper, keeping concrete away from seal.



WITH ENCLOSED GEAR CASE ON DISCHARGE CONTROL . . . permitting remote control of discharge door.



TO DESIGN, FIELD TEST, PRODUCE AND SUPPLY THE ADJUSTA-HITE MOTO-MIXER . . . field-tested 2 years prior to production . . . universally accepted as a premium machine since production started in October, 1948.



To APPLY AND FIELD-TEST A FLUID DRIVE COUPLING FOR TRUCK MIXERS. FIRST to realize the advantages and user benefits possible through application of fluid couplings . . . development and testing started April, 1945 . . . continuous field testing for almost 5 years.



TO PRODUCE AND MARKET A THOROUGHLY FIELD-TESTED TRUCK MIXER WITH FLUID DRIVE COUPLING. FIRST to ship production models . . . September, 1949.

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IN LOW MAINTENANCE COST

• IN LESS LOST OPERATING TIME

• IN LOWEST OPERATING COST

**NATURALLY** when the art of truck mixer design and production progresses to even greater developments permitting lower maintenance, less lost operating time, lower operating costs, Rex will again be first to offer field-proved machines of higher efficiency.

CHAIN BELT

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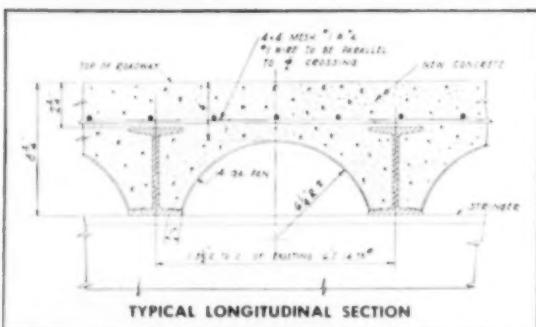
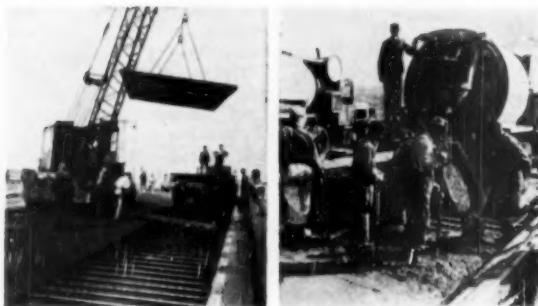
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► HERE'S WHY THEY ASK FOR 'INCOR'

**IT'S SKID-PROOF NOW!**



## 'INCOR' CONCRETE REPLACES GRID BRIDGE-DECK ON LONG ISLAND CITY APPROACH TO NEW YORK'S QUEENS-MIDTOWN TUNNEL



LONE STAR CEMENTS COVER THE ENTIRE CONSTRUCTION FIELD

**M**IDL TOWN Elevated Express Highway carries 11-million vehicles a year to and from Queens-Midtown Tunnel. Where this Highway crosses high above Dutch Kills, the steel-grid bridge-deck was hazardous when wet or icy—sand and salts fell through. For safety's sake, the City's DEPARTMENT OF PUBLIC WORKS decided to rebuild the deck with concrete.

**EDGECLIFF CONSTRUCTION CORP.**, of Long Island City, rebuilt a lane at a time, to minimize motorists' inconvenience. Removing the grid sections, total 32 ft. by 1040 ft., required cutting 56,000 welds. Grids were lifted by crane, then permanent metal-pan forms were inserted between transverse I-beams, and mesh-reinforcing and concrete placed.

For durability and wear-resistance, and because much of the work was done in cold weather, 'INCOR'® AIR-ENTRAINING 24-HOUR CEMENT was used throughout. Gaining service strength in a fraction of the usual time, 'Incor' minimized freezing risk in this highly exposed location, where heat protection was out of the question.

Motorists were quick to notice the sure-grip of concrete under wheel. Further proof of the axiom that traffic safety begins with the pavement! Reg. U. S. Pat. Off.

Reg. U. S. Pat. Off.

**MIDTOWN HIGHWAY CROSSING - QUEENS COUNTY, NEW YORK CITY**

Bridge paving rebuilt under supervision of:  
**DEPARTMENT OF PUBLIC WORKS, CITY OF NEW YORK**

Consulting Engineers: HARDESTY & HANOVER, New York

#### Ready-Mix 'Incor' Air-Entraining Concrete

TRANSIT-MIX CONCRETE CORPORATION, New York

Contractor: EDGECLIFF CONSTRUCTION CORP., Long Island City

# LONE STAR CEMENT CORPORATION

Offices: **ALBANY** • **BETHLEHEM, PA.** • **BIRMINGHAM** • **BOSTON**  
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**ST. LOUIS** • **PHILADELPHIA** • **WASHINGTON, D. C.**

LONE STAR CEMENT, WITH ITS SUBSIDIARIES, IS ONE OF THE WORLD'S LARGEST CEMENT PRODUCERS. 15 MODERN MILLS. 27,500,000 BARRELS ANNUAL CAPACITY.

# Control Method for Consistency of Concrete

**Kolinski Concrete Co., Milwaukee, Wis., uses new device to control plasticity of concrete in central mixing plant operation. Drum-type, non-agitating delivery equipment in use**

By DAVID MOCINE

**M**ILWAUKEE, Wis., has long been recognized as a focal point in design, development and production of concrete products machinery; and is now the site of the latest and possibly most important development in control of plasticity of concrete mixed in a tilting-type mixer. The device, the Plastograph, is the key around which the new central-mix plant, No. 2, of Kolinski Concrete Co. has been built.

This meter shows an instantaneous determination of concrete plasticity for each revolution of the drum. By using this meter, a correction in the water ratio can be made while the concrete is still being mixed. This plant also incorporates a new principle of mixer tilting in the Expressway Mixer which has been designed for a portable central-mix plant. Both of the units mentioned were designed by Glenway Maxon, Jr., Milwaukee consulting engineer, who also has designed the Dumperete body, one of the first non-agitating type concrete delivery bodies.

M. C. Kolinski, owner of the com-

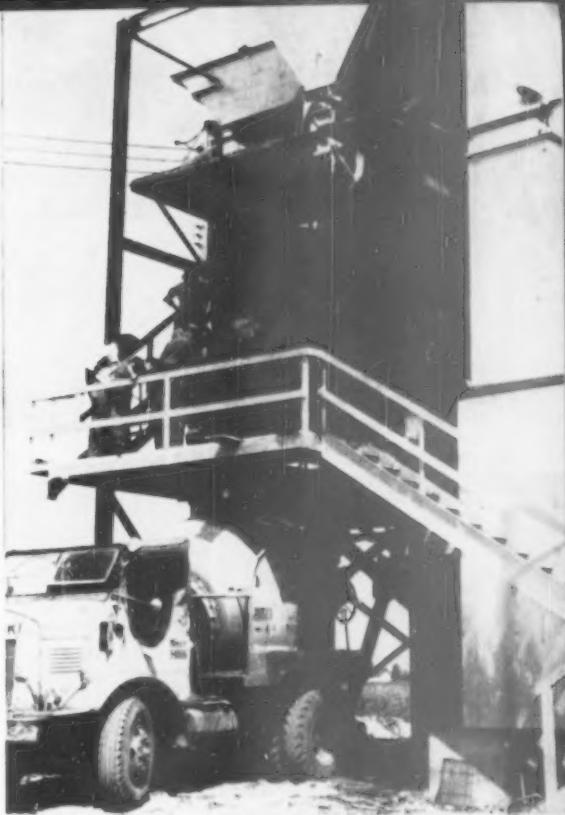
pany bearing his name, and one of the larger ready-mixed concrete producers in a city that has been made "ready-mixed concrete conscious," worked closely with Mr. Maxon in development of this first plant to embody the many new features. Mr. Kolinski also incorporated some new ideas and methods to the operation such as his Concrete Carrier, a non-agitating, drum-type concrete delivery unit. This concrete delivery body, capable of hauling 5 cu. yd. of concrete, can be mounted on a 4-wheel chassis with 120-in. wheelbase and carry one cu. yd.

of concrete per 1000 lb. of carrier weight.

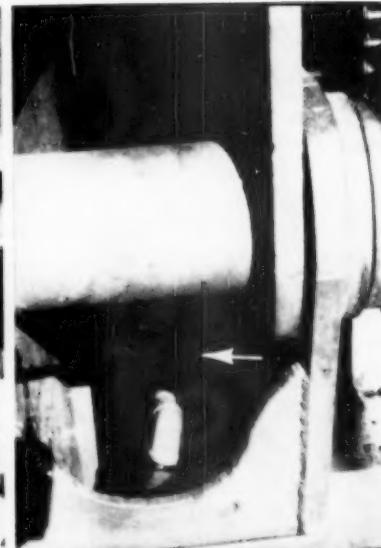
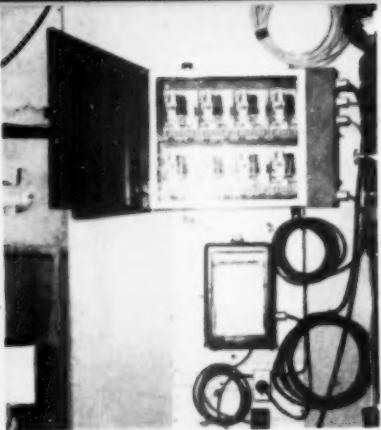
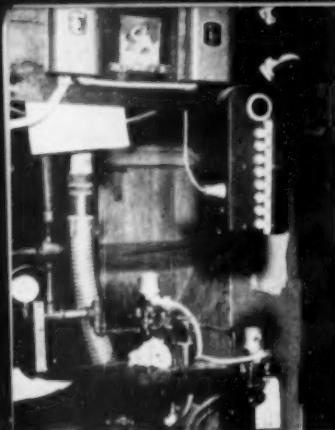
The Plastograph, through which control of plasticity is achieved, has been used successfully in the central-mix plant producing concrete for construction of Allatoona Dam (see *Rock Products*, May, 1948, page 134). This meter consists of a saucer-shaped steel plate attached to the inside of the mixer. It is activated by the concrete mix impinging on it, once in each revolution of the drum. This plate is mounted on a pivotal shaft that extends through the side of the drum and when the plate is moved by concrete striking it, slight rotation of the arm is registered electronically by contact with a series of electric points or probes mounted on the mixer frame. It is the instant of impact—not the amount of deviation of the blade from its normal vertical position, as registered, that is a measure of plasticity of the mix. Point at which this contact is made is registered both on a visual light indicator panel and also by a continuous graph, an Esterline-Angus recorder (see illustration).

Concrete mixer blades, which are attached to and revolve with the drum in the usual manner, are designed differently from the conventional blades for two reasons: to make readings

Closeup of 5 cu. yd. mixer truck as it pours to foundation of large housing project



Engineers, owner and workmen check consistency and non-segregation of first load of concrete delivered by new mixer. Truck is mounted with a non-agitating, drum-type concrete delivery unit



possible on the Plastograph and to impart a kneading action to the concrete. This last allows for more thorough mixing without possible down-grading of large aggregate. At one point in the circumference of the drum the gap between mixer blades is wider and allows concrete from both ends of the drum to flow through the opening counter-current to blade rotation. The instant of flow of the concrete through the opening, as it impinges on the meter plate, is recorded as consistency or plasticity of the mix. This meter permits a change in moisture content in time to make a correction while the concrete is still in the mixer.

As a measure of workability, the U. S. Corps of Engineers at Allatoona Dam found the device more dependable than an inspector's visual test, and also more dependable than wattmeter or the time-consuming slump test. A variation in water batching sequence is registered by this device which works with equal efficiency on aggregate from  $1\frac{1}{2}$  to 6 in. in size. Some minor troubles experienced at the Allatoona installation, such as shorting of the electrical circuits, have been corrected through its use there.

This method of measuring plasticity of concrete while it is still in the mixer is adaptable only to the tilting-type mixer at the present time; but this meter would seem to have a wide field of application if it could be adapted to the open mixers used in concrete products plants.

Mounted on an A frame, the mixer at this new plant is separate from the bin structure. This design is the essential part of the Expressway portable central-mix concrete plant, as the mixer may be moved by truck from location to location without violating weight or width limits on highways. The clamshell-charged overhead aggregate bins are moved in a separate truck and then erected over the mixer at the new site.

Dumping angle of this mixer is different from the usual tilting mixer and has been compared by its inventor to a pitcher pouring liquid. Hydraulic jacks built into the framework at each side of the 3-cu. yd. mixer lift the rear of the drum in such a manner that concrete is poured from it smoothly, which method pre-

Top: Left, indicator light panel gives Plastograph reading once in each drum revolution to indicate concrete plasticity. Right, recorder for continuous recording of concrete consistency. Center: Left, Plastograph consistency meter plate and specially-designed mixer blades. Arrow shows gap in mixer blades at meter plate which allows concrete to flow between them and impinge on plate. Drum revolves to right. Right: Exterior of concrete mixer drum showing contact arm (arrow) that strikes series of electronic probes mounted on mixer frame. Bottom: Left, V-belt connection between 40-hp motor and mixer drum with power take-off chain. Right, arrow points to one of two hydraulic cylinders inside frame supporting mixer drum. Drum bearing is above it.

vents down-grading of large aggregate and segregation through excessive movement and splashing. The oil-hydraulic pump for the dumping mechanism is driven by the 40-hp. motor that furnishes mixer-drum power. Thus mixer is a self-contained unit with its own dumping device.

Aggregate and bulk air-entraining cement are delivered to the new plant by truck. Cement is dumped to the boot of a bucket elevator serving a 210-bbl. overhead bin, with overflow being directed to a 100-bbl. ground storage bin. It is planned to add a 160-bbl. overhead bin that will hold standard portland cement.

Aggregate is dumped from trucks to ground storage in a semi-circle around the base of the plant, from which it is elevated to three overhead bins of 75-ton total capacity by a Link-Belt 1½-cu. yd. clamshell. The entire bin structure was designed and fabricated by the company.

Weigh batcher at this plant is suspended from a frame mounted on the batch floor so that when a cubic yard of aggregate is dumped to the overhead hopper it does not affect the scale reading. A Howe recording scale is used at this point which makes an electric stamp of the weights in each batch. Flow of both cement and aggregate are stopped when the weight limit has been reached by closing of gates with a hydraulic ram activated by an electric-eye through a solenoid valve.

This new plant literally has been built in the middle of a corn field, but management does not expect to derive any large percentage of business from the farm trade. The corn field chosen for erection of the plant lies north and west of the city of Milwaukee. This territory, with its increasing importance for factory sites, will be incorporated soon within the city limits of Milwaukee. First pour from this new mixer went to a municipal housing project being constructed for the increased population of the area.

Mr. Kolinski plans to purchase six additional carriers for delivery of concrete from the new central-mix plant. The company now has ten of these carriers in use—nine Jaeger units and one Chain Belt Co. unit. These drum-

M. C. Kolinski, owner of new central-mix plant, left, and Glenway Maxon, Jr., Milwaukee engineer and designer of the plant

type bodies are classed as 3-cu. yd. capacity, but are capable of carrying 5 cu. yd. of concrete due to the fact that they contain no mixing blades. Drums on these carriers are revolved only at destination so that the discharge blades can function. They are driven by chain from a split-shaft power take-off. All carriers owned by the company are mounted on International KR-11 class trucks, commonly known as "Burma Road Jobs." These trucks, originally designed for the narrow Burma Road that is so notoriously full of twists and turns, have 120-in. wheelbase, which makes them easily maneuvered when pouring in such places as streets and alleys where sewer, water and gas mains and catch basins protrude.

**Top:** Water meter used in batching central-mixed concrete. **Center:** Power take-off arrangement on concrete carrier. **Bottom:** Note even consistency of concrete as it issues from carrier

## Hardening Concrete Before Prestressing

IT IS POSSIBLE to harden concrete or mortar sufficiently to grip stretched wires to permit the application of prestress to a given member by heating the specimen to 160 deg. F. for six hours. M. R. Ros, Zurich, Switzerland (*Schweizer Archiv*, Vol. 15, No. 2, p. 48, 1949), has developed a beam and floor made of prestressed clay tile using this system. The most convenient method of application of heat is through electrical units, since the locus of application can be so readily controlled.

## Concrete Pipe Firm Opens New Plant

UNIVERSAL CONCRETE PIPE Co., Columbus, Ohio, has put a new concrete pipe plant in operation at Tampa, Fla., to serve the entire Gulf Coast market, according to H. X. Eschenbrenner, president. This plant, at Hooker's Point Shipyard in Tampa, becomes the 18th unit in Universal's chain. Material will be shipped by barge and rail to the Gulf market. All pipe manufactured will be 8 ft. long and will range up to 84 in. in dia. I. A. Heinzman is in charge of construction.

## Dissolve Partnership

A. J. WALKER AND A. C. HUCKABA, owners of the Walker Construction Co., Mattoon, Ill., since its establishment in 1935, have announced dissolution of their partnership in the business. Mr. Walker will continue in the ready-mixed concrete business in Mattoon, while Mr. Huckaba will take over the firm's Charleston ready-mix branch. The two men will continue to operate jointly their Wilbert burial vault franchise in Terre Haute, Ind.



# Modern Block Plant Design

**Plant of the Carter-Waters Corp. utilizes modern concepts throughout including use of gravity, accelerated curing, paved yarding areas, and provides for batching lightweight ready-mixed concrete**

**T**HE NEW HAYDITE concrete block plant of The Carter-Waters Corp., Kansas City, Mo., which had been under construction since the middle of April, 1949, went into production September 10, 1949. It marked the completion of expansion planning which started with the raw material and progressed to haydite in concrete form for the ultimate consumer.

The original haydite plant in Kansas City was operated in the early 1920's by Dan Servey, and in addition to making the lightweight aggregate, he manufactured concrete block, largely as a medium for making haydite better known to the public. Following the death of Mr. Servey, The Carter-Waters Corp. took over the plant in 1943 and immediately instituted a rehabilitation program for building and equipment, including a new Jolitecrete machine.

The location at 32nd and Roanoke Road was not well suited to the business, so in February, 1948, the company opened its new haydite manufacturing plant of 300 cu. yd. daily capacity at New Market, Mo., a short distance from Kansas City in Platte county. (see *Rock Products*, July, 1948, p. 122) Manufacture of concrete block was suspended during the period of transition, but now has been resumed at the new plant after an eleven month interval.

Located on an eight and one-half acre tract of ground alongside the Kansas City Terminal Railroad company on ground that slopes to heavily traveled pavement on two sides, the plant makes an impressive appearance. Even in a building erected primarily for utilitarian purposes, the hand of the architect can be seen in the general trimness of the layout, the modern look, and the use of brick for decorative purposes around window and door openings.

The services of Archer Cooper & Robison, architects, and of the Long Construction Co., general contractors, were used. Both are Kansas City firms. The engineering department of The Carter-Waters Corp. was responsible for the plant design which came as a result of long study and ideas gathered in visits to many other plants.

Many innovations are apparent on even a casual trip through the plant. Ample room for future expansion has been provided, not only for concrete manufacturing but also for the proc-

**By TIP BROWN**

essing of various other materials which Carter-Waters uses in its distribution.

The plant is in easy reach of the heavy manufacturing and thickly populated areas of the Blue Valley and North East industrial districts, and near the growing suburban sections of eastern Jackson county and Clay and Platte counties on the north side of the Missouri river. The location is well adapted to serving other parts of Kansas City by easy access to through traffic ways.

In the unloading of bulk materials, haydite aggregate from the plant in Platte county is delivered either by truck or hopper bottom coal cars and is dumped into an 8 x 16-ft. steel cone-bottom hopper. It passes onto belt conveyors and by vertical bucket elevator to overhead storage bins. A ground storage haydite stave silo, 20 ft. in diameter and 40 ft. high, holding 450 cu. yd. of aggregate, stores the overflow from the overhead bins and can be drawn upon to supply aggregate direct to the overhead bins, all using the same distribution system.

A similar design has been worked out in the handling of bulk cement from covered hopper bottom cars by

screw conveyor and vertical bucket elevator to the 200-ton overhead bins. The auxiliary reserve ground storage tank for cement holds 650 bbl. It may be utilized to take care of any overflow or can be drawn upon to supply cement direct to the overhead bins.

From the 80 ft. height of the distribution system, materials are fed to the overhead bins and on to a traveling weigh batcher on a horizontal track. A large 50-cu. ft. and a small 18-cu. ft. Gene Olsen mixer take care of the present plant requirements. The larger mixer discharges into a hopper connected with the No. 9 Jolitecrete block machine on the lower floor level. The small mixer discharges into a hopper connecting with a traveling bucket on a mono rail which serves the lesser needs of an 8 x 18-ft. vibrating table for manufacture of lintels, joists, or special precast items.

A new service to extend the uses of haydite for ready-mixed concrete and to cut down delivery time of transit mix trucks is being inaugurated. From the overhead mixing floor, specification haydite and portland cement mixed in dry form are discharged through a hopper into waiting transit mix trucks outside the building. Water is available if needed. The ready mix truck is saved much time on this pick-up service in avoiding long trips to its home base and through possible



Paved areas surrounding the plant for storage of block and other concrete products cover over 17,000 sq. ft.

delays in shifting home plant operations to supply a special type of concrete materials.

Haydite block are handled by power lift trucks from the block machine to the four curing kilns. They are 13 ft. 6 in. wide, 52 ft. long and 8 ft. high, and are built of haydite block for the walls, haydite concrete joists and filler block on the roofs and poured concrete for floors. Room has been provided for a second battery of four kilns, when and if they are needed.

Campion Accelerator System for curing has been installed. Saturated air at 170 deg. F. is introduced through four aluminum ducts in each kiln wall and, after thorough soaking, is exhausted and replaced with hot dry air which circulates throughout the kilns, drawing the moisture from the block. The result is a block having high early compressive strength.

All kilns are equipped with recessed electric lights and with floor drains. Entrance doors are of aluminum with special arrangements for tight closing. The latest type opening devices also are provided.

The paved areas surrounding the plant for storage of block and other manufactured concrete products cover more than 17,000 sq. ft. A circular, one-way drive around the plant permits delivery trucks to enter and pick up loads with a minimum amount of traffic congestion.

Construction materials used in the building consist of haydite block walls, precast haydite concrete roof slabs, steel roof trusses, and aluminum siding around overhead bins. Particular attention was given window capacities and ventilation. Winter heat is supplied by unit oil heaters. The manufacturing area contains 3000 sq. ft. of floor space with 20-ft. ceiling height. The plant office adjoins it on the south, and a shower, toilet, and wash room is on the north.

Neil Lidstone, an engineer with the company for the past five years, is superintendent of the plant. Prior to that time, he was a materials engineer for the Missouri State Highway Department. George W. Kulhavy is in charge of sales of haydite and haydite products.

The Carter-Waters Corp. was organized January 1, 1922, by E. Kemper Carter, now chairman of the board, and Albert R. Waters, now president and general manager. Walter E. Beanway is secretary and treasurer and N. R. Smith is vice-president and general sales manager. The company has occupied its own building for the past 19 years at 2440 Pennway, Kansas City, Mo. In addition to its extensive investment in the production and use of haydite at the New Market and the Kansas City block plants, the company is a large distributor of materials and manufactured products for highway, street, and general construction use.



General view of new haydite concrete block plant of Carter-Waters Corp. at Kansas City, Mo.

## Proportioning of Concrete

NATIONAL READY MIXED CONCRETE ASSOCIATION, Wash., D. C., has recently issued a revised edition of the booklet titled: *The Proportioning of Concrete*. The paper was first presented by A. T. Goldbeck before the 1946 Association convention. The present edition was revised in 1949 by Mr. Goldbeck and J. E. Gray to take into account the advances in concrete technology represented by air entrainment.

## Variations Affecting Quality of Concrete

VARIATIONS in quality of concrete usually are referred to in terms of the compressive strength of test cubes. A paper by F. N. Sparkes, Road Research Laboratory, Department of Scientific and Industrial Research, London, England, and reported in *Highway Research Abstracts*, lists the

factors contributing to this variation and attempts to assess their relative importance and so deduce the nature of the improvement effected by their control in the field. The probable variation in concrete strength caused by the several factors is summarized in Table 1.

The variations in concrete quality may be expressed as the ratio of the minimum strength to the average strength, and the closer this approaches unity, the more uniform and the more economical will be the concrete. The ratios in Table 2 have been suggested as a reasonable assessment of the effects of control.

## Zonolite's New Office

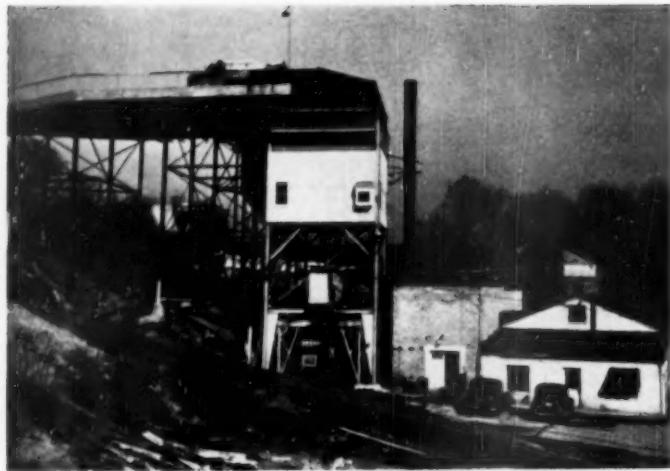
ZONOLITE CO. has moved its New York City sales office from 50 Church Street to the Chanin building, 122 East 42nd Street.

TABLE 1

Factor causing variation	Total variation in concrete strength as a result of this factor
Quality of cement	Up to 50 percent or more
Grading of aggregate	20 percent maximum
Bulking of fine aggregate	10 percent maximum
Batching (a) by weight	8 percent
(b) by volume:	
(i) good	16 percent maximum
(ii) normal	20 percent maximum
(iii) bad	100 percent maximum
Compaction	Unknown, may be eliminated completely by attention to detail
Handling-mixing and transporting	Unimportant after 28 days, provided temperature is above freezing
Temperature	Approximately 30 percent
Other factors in making and testing of test cubes	

TABLE 2

Degree of control	Methods to be used	Ratio minimum strength average strength
Excellent	Weigh-batching, controlled grading, moisture determinations in aggregate and control of the water-cement ratio; constant supervision.	0.75
Normal	Weigh-batching or accurate volume-batching; coarse and fine aggregate not individually subdivided; weighing mixed by mixer operator.	0.60
Poor	Volume-batching of all materials; use of all-in batcher, no skilled supervision.	0.40



General view of neat and well designed plant of Clark Certified Concrete Co., Inc. Truck above is dumping aggregate to bins. At right is boiler room, maintenance garage and repair shop

New plant at Baltimore, Md., takes advantage of terrain for gravity operation and low cost handling of materials

## CENTRAL-MIXED AND TRANSIT-MIXED CONCRETE

ONE OF THE recently built ready-mixed concrete plants to serve the Baltimore, Md., area is that of Clark Certified Concrete Co., located at Reister Avenue and Overbrook Road in the northern part of the city. Like many of the newer plants, the company can supply pre-mixed concrete or can batch direct to its fleet of 14 Jaeger mixer trucks mounted on Mack chassis. All the mixers are 4½ cu. yd. rated capacity as mixers and will carry 6 cu. yd. of central-mixed concrete.



W. W. Duncan, vice-president and general manager

The company has taken advantage of the local terrain and has designed a gravity plant so that no elevators are needed. A reinforced concrete and steel ramp enables trucks to dump directly into the aggregate bins. Portland cement is hauled in bulk at the rate of 600 to 800 bbl. per day, using a conventional covered truck body mounted on an International chassis. The cement is loaded through two covered hatches in the top of the steel body, which holds 40 bbl. of cement. A rack and pinion gate, the width of the truck, has been provided at the dump end. The distance from the rail head near Towson, Md., is about two miles. On arriving at the plant the truck unloads to a protected dump site that serves a 1000-bbl. silo. Aggregate trucks use the same ramp and dump to either of four compartments, each of which holds 100 tons.

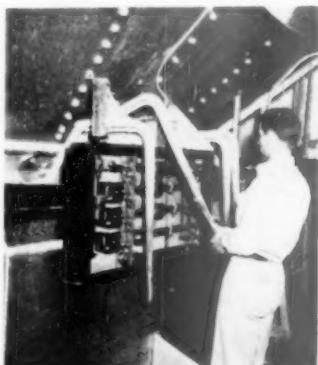
### Batching Facilities

The plant is a very well designed, neatly laid out operation, and the company makes a point of keeping it clean and orderly. It has been the "Mecca" of many visitors, some from Europe, as well as of many producers in the United States. The batching equipment and scales are of Blaw-Knox manufacture and the mixer is a 3-cu. yd. Ransome unit. Dexrex is used as the air-entraining agent and is proportioned to the 5-cu. yd. weighing hopper by a Dexrex dispenser.

Adjacent to the plant are a well

stocked store room and garage repair facilities where, during the winter months, all haulage equipment is given a thorough overhauling. A neat office also is located near the new plant.

During the winter months, heated water is supplied by a fully automatic, oil burning, National Radiator steam plant that is designated as a 24-130 CI tankless heater and is said to be the only one of its kind in the Baltimore area. There is no provision for storing hot water in the unit as it cuts in very rapidly and can deliver 100 g.p.m. at 140 deg. F. An Ace oil burn-



Operator at scales in batching plant

er, with air supplied by a small Quincy compressor, fires the boiler.

Cement from the silo is delivered to the batcher by an inclined 12-in. screw conveyor that has a baffle across the lower half of the discharge end to help minimize flooding. The conveyor slopes at 16 deg. The scale hopper has two outlets; thus the mix can be sent to the Ransome unit or be dumped direct to the truck mixers. These are all used as mixers and not as agitators. The company has testing equipment on hand and sieve tests of the sand and its water content are made twice each day.

The company has its own sand and gravel washing plant on Joppa road about six miles from the ready-mixed concrete plant. This plant has a 1½-cu. yd. Osgood shovel, a 1-cu. yd. dragline of the same make, and a Lorain 45 clam shell. The washing plant has mostly Telsmith equipment.

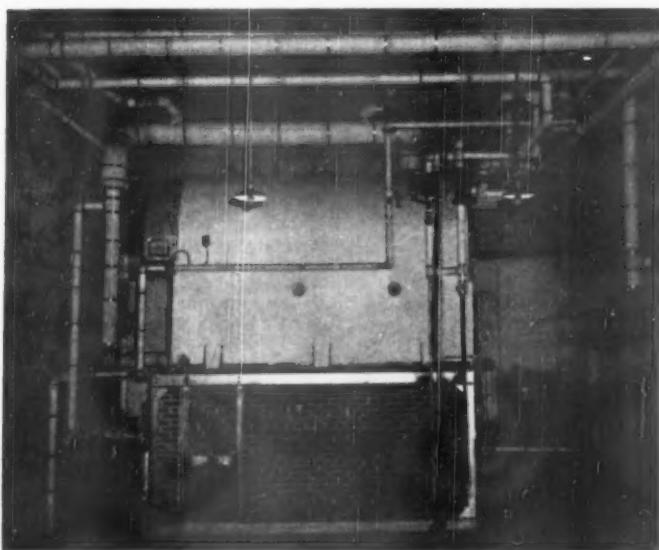
Officers of Clark Certified Concrete Co., Inc. are: J. Meyerhoff, president, and W. W. Duncan, vice-president and general manager.

### Truck Mixer Standards

THE TRUCK MIXER MANUFACTURERS BUREAU, an affiliate of the National Ready Mixed Concrete Association, has recently completed the second revision of its Truck Mixer and Agitator Standards. Changes provide for three additional larger sizes of the open-top type of mixer. Added sizes are 2½-, 3- and 4½-cu. yd. A minor revision is the change of the agitator capacity of the 1¾-cu. yd. unit from 2½ to 2¾ cu. yd.



Top: Ramp for dumping the aggregate. Portion to left is used by the bulk cement truck. Bottom: Loading material to truck in sand and gravel pit, located about six miles from the ready-mixed concrete plant.



Fully automatic oil-burning plant supplies heated water during winter operations.

### Short Course on Concrete

THE SHORT COURSE on aggregates and concrete sponsored jointly by the University of Maryland, the National Ready Mixed Concrete Association and the National Sand and Gravel Association was held recently. As was the case last year, the large enrollment made it necessary to divide the class into sections for several of the sessions in order to give more personalized instruction. Enrollment has increased from 31 at the first short course held in 1946 to 102 at the 1949 session. The greatest number of participants consisted of employees of member companies. With only two exceptions all instruction was carried out at the University by the Associations' staff.

### Cover Picture

PRECAST channel floor system shown is being installed by Walles-Bageman, Inc., Los Angeles, Calif., in the erection of a grandstand in Hollywood Park. Walles-Bageman is one of the pioneers in precast floor construction which offers a wide and expanding market for concrete products producers.



Aerial view of new Honolulu Construction & Draying Co. plant. Ready-mixed concrete section is to left. Batcher, plant, and storage area for concrete products are located right. In the foreground are stockpiles of cinders. Garage and repair shops are in background, left.

## Producing Concrete in Hawaii

**Honolulu Construction & Draying Co., Ltd., has large volume of ready-mix business and makes diversified line of concrete products**

PRODUCING CONCRETE PRODUCTS in the middle of the Pacific Ocean presents many difficulties not encountered by mainland operators, but the Honolulu Construction & Draying Co. has been doing just that in Hawaii for several years.

The company was established more than 41 years ago. As the name implies, it originally engaged in the hauling and contracting business. Hauling, and storage as well, remain important parts of the company's business today, but the construction business was discontinued many years ago. Since other contractors were the company's best customers, H. C. & D. decided to concentrate on supplying them with crushed stone and other concrete aggregates and concrete masonry units.

In 1941, just before Pearl Harbor, the company bought a parcel of land

By HERBERT MONIZ\*



The author

in the Kalihi area of Honolulu. Shortly after the war, an additional area was purchased making a total area of 17 acres. In January of 1947, construction of a new plant to house all the concrete and concrete products operations was begun. This million and a half dollar plant was completed and put into operation in 1948.

A unique feature of the plant layout is the storage system. Trucks hauling the aggregates unload on a double trestle over a double set of storage bins. Beneath one side of the trestle are the bins for concrete aggregates. Beneath the other side are bins for the concrete products operation. Under the bins are conveyor belts supplying the batchers for making concrete and concrete products. Bin gates and conveyor belts are remotely controlled by bunkermen on the tops of the batchers by interlocking electrical relays.

The ready-mixed concrete division

\*Manager, Concrete Products Division, Honolulu Construction & Draying Co., Ltd., Honolulu, Hawaii.

supplies between 125,000 and 150,000 cu. yd. of concrete a year. The division operates 30 mixer trucks, a Mixermobile and a Dumperete. A second batching plant is operated at the quarry six miles away so the trucks are able to operate on three mile radii. Since the company's aggregates are 100 percent crushed and therefore produce somewhat harsh mixes, Darez AEA is added to the concrete to increase plasticity.

#### Concrete Products Plant

The concrete products division produces Holl-O-Bloc in various sizes and styles; Kolor-Bloc, which is Holl-O-Bloc with an added coloring agent; both packerhead and centrifugal concrete pipe; Bartile, a concrete roofing material; meter boxes; laundry trays, and other concrete products.

In the new plant there are separate groups of steam curing rooms for both block and pipe. These, of course, make it possible to deliver the products within a short time after they are manufactured and eliminate a long yard curing process. There is a large storage area for both block and pipe.

The chief difficulty in operating in Hawaii is the fact that many materials like cement and steel must be brought in from the mainland 2400 miles away. There are compensations, however. For example, the company uses beach sand which is of such quality that it need be screened only before it is used as an aggregate.

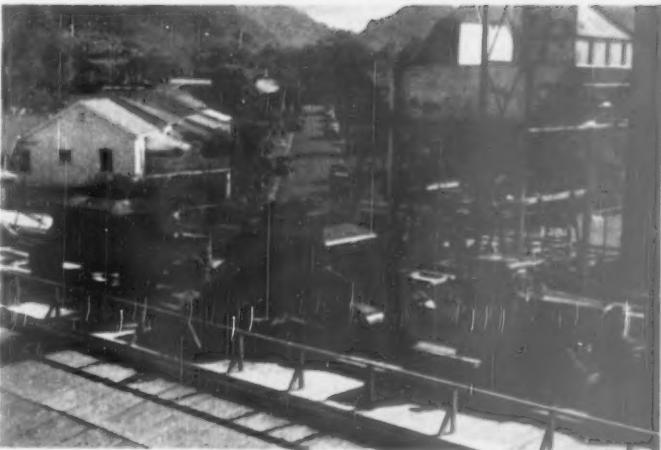
All the sand comes from Honolulu Construction and Draying Co.'s sand pit at Kahuku, Oahu. With a one man operation, the sand is readied for the haul to Honolulu. A conveyor belt, housed in inverted U-shaped concrete slabs that were used as air raid shelters during the war, runs from the center of the stockpile to the screens over the storage bunker. The sand is piled over the belt housing with a bulldozer.

To haul the sand to Honolulu, three Kenworth diesel trucks are used, each towing a semi- and a full trailer unit. The rig carries 20 cu. yd. of sand with a gross vehicle weight of 80,000 lb.

Cinder for concrete masonry units is obtained in a like manner from Tantalus, an extinct volcano overlooking Honolulu. The cinder in reality is volcanic ash and is often called black sand in Hawaii.

For nearly 40 years the company obtained its rock from its Moiliili quarry. This quarry was exhausted very recently and the rock now comes

**Top:** Unloading aggregates on a double trestle over a double set of storage bins. One bin serves batchers for concrete block, pipe and other products (left) and the other bin serves the ready-mixed concrete batching plant (right). **Center:** Sand units, powered by 200-hp. diesel tractor. Full trailer and semi each have 10 cu. yd. capacity. **Bottom:** View of block and pipe storage area looking toward the concrete products plant





Cinder pit in the side of Tantalus, an extinct volcano overlooking Honolulu, is source of aggregates for concrete and concrete products.

from the firm's Palolo Valley quarry. The material itself is high quality, clean lava basaltic rock. The quarry supplies not only the company's own needs but a majority of the needs of the Territorial and Federal governments' building programs, the Army and Navy, and private contractors.

Honolulu Construction and Draying Co.'s operations are under the direction of LeRoy C. Bush, president and general manager, who has been with the company for more than 18 years, and Robert L. Muller, assistant manager. Richard N. Mossman is manager of the concrete division, Herbert H. Moniz, manager of the concrete products division, and Waldo Arnole, manager of the quarry.



Robert L. Muller, left, and LeRoy C. Bush

### Properties of Lightweight Aggregate Concrete

RESULTS OF STUDIES of lightweight aggregates and concrete conducted at the National Bureau of Standards are described by the Bureau as follows: Samples were limited to one of each type of aggregate material, except for three samples of slag. The investigation was also restricted to plastic concrete as distinguished from pressed or tamped concrete as used in concrete masonry units.

Eleven lightweight aggregates were included in the Bureau's study. These consisted of: exfoliated vermiculite; two processed materials, sintered diatomite and fly ash; perlite, an expanded material white in color, composed of frothy particles which were fragile and irregular in shape; expanded slag No. 1, a slag expanded in the pit process; expanded slag No. 2, a slag expanded from runner; expanded slag No. 3, a machine-processed expanded slag; expanded shale; expanded slate; expanded clay, and

one natural material, pumice. The samples of expanded slate and expanded clay were furnished for experimental purposes by the Bureau of Mines, College Park Station; the other nine were commercial products. For comparison, Potomac River sand and gravel was also included and treated in the same manner as the lightweight aggregate.

The investigation at the Bureau consisted of two parts: (1) Tests concerned with the properties of the aggregates themselves and (2) tests

to determine the properties of concrete containing various proportions of cement and aggregates (Table 1). Because of the angular character of the individual particles and their peculiar absorptive properties, techniques for testing, proportioning and mixing the aggregates differed somewhat from those used for the ordinary natural dense aggregate mixtures.

The proportions of cement to aggregate were such as to produce concrete mixtures from each aggregate containing nominally 3, 5, 7, and 9 bags of cement per cu. yd. of concrete. The consistency of each batch of concrete was measured by means of the standard slump test. Test specimens were prepared in triplicate except for the compressive-strength and the thermal-conductivity tests. Five like specimens were used for the former and one for the latter.

### Air Entrainment

Air entrainment was found to assist materially in promoting workability of the concretes made from lightweight aggregates. Such entrainment of air enabled the cement and water to remain in suspension throughout the mass of the concrete whereas without the air, the ingredients would have segregated. The entrained air also acted as a lubricant, allowing the concretes to flow readily into the forms with a minimum amount of puddling or vibrating. Though it has a small effect in reducing the weight of concrete, the entrained air was greatly beneficial in increasing resistance to disintegration by freezing and thawing.

The lightweight concretes investigated ranged from one-fifth to three-fourths of the weight of ordinary sand-and-gravel concrete. The density, which varied with portland-cement content, ranged from less than 50 lb. per cu. ft. (vermiculite and perlite) to 110 lb. per cu. ft. Sand and gravel concrete weighs about 145 lb. per cu. ft. The range between 70 and 110 lb. per cu. ft. included the pumice, slags, sintered fly ash and expanded clay, shale and slate aggregate concretes.

The compressive strength of air-dried concretes, tested at 28 days, was markedly affected by the amount of cement in the mix. Considering 5-sack-per cu. yd. proportions, compressive strengths of the concretes ranged from less than 300 lb. per sq. in. for those with vermiculite and perlite aggregate to approximately 5000 lb. per sq. in. for that with sand and gravel aggregate. The majority of the light-

(Continued on page 172)

AGGREGATE
Steve Analyses
Specific gravity
Absorption
Unit weight
Grading (mechanical analysis)
Crushing strength

CONCRETE
Compressive strength
Flexural strength
Shear strength
Absorption
Elastic modulus—static, dynamic
Resistance to freezing and thawing
Thermal conductivity

Table 1: Types of tests for aggregates and concrete

# READY MIX For Concrete Highway Construction

**Missouri State Highway Department  
turns to ready-mixed concrete for  
convenience in building bridges and  
culverts**

By E. H. LOGAN\*



**Richmond plant, situated between the two thriving towns of Richmond and Excelsior Springs, is built up against a hillside, making it an ideal set-up for a belt conveyor from the stockpiles**

**T**RANSIT MIXED CONCRETE for Missouri State Highway construction was not potential business when concrete producers in four county seat towns of Clinton, Carrollton, Lexington and Richmond, Mo., built their concrete batching plants. In these agricultural communities, farm buildings and allied industries together with large and small manufacturing were expected to furnish the total demand for concrete.

Then contractors on eight state highway projects in western Missouri elected not to set up small mixers and aggregate scales but to purchase

their concrete delivered to the project from established transit mix companies which were furnishing concrete for general construction work.

The state highway contract called for 300 to 500 cu. yd. of masonry concrete for bridge and culvert construction financed from Federal and State funds. Concrete for eight projects was mixed and hauled during the construction season of 1948 and 1949. The quantity in each pour varied from 10 to 60 cu. yd.

Concrete proportions of 1:2.03:3.82 by weight of Type I cement, Missouri River sand, Bethany Falls or Burlington limestone with average 5.8 gal. of water per sack of cement were used

on these eight projects. The slump varied from 2 to 4 in. but most of the concrete was poured at a 3-in. slump. Quantities of 1.37 bbl. of cement, .63 tons of sand and 1.01 tons of stone were average requirements for a cubic yard of concrete.

No concrete for this work was furnished when the air temperature was below 32 degrees. During the late fall of 1948, on days when the air temperature was near 40 degrees, boiler heated mixing water raised the temperature of the ingredients so that the concrete was deposited in the forms at 65 degrees after a haul of 4 miles from the Clinton plant.

The maximum haul to these eight projects was about twenty miles. Compressive strength of 71 concrete cylinders made on these projects and tested in the laboratory at 28 days averaged 4490 p.s.i.

## Batching Plants

The batching plants, containing conventional sand and stone bins, weighing hoppers, and elevating buckets or belt conveyors, are of fabricated steel construction. Cement is handled in sacks; water is batched at the plants by volume. At the Clinton plant aggregates are stockpiled on concrete bases and reclaimed by front end loaders. Facilities are provided at the Clinton, Carrollton and Lexington plants to handle truck or rail shipments of materials. Space for stockpiles is limited at all but the Richmond plant. Schedules for delivery of aggregates and cement are arranged and few delays have occurred while hauling concrete to state

\*Division Materials Engineer, Missouri State Highway Department, Kansas City.



**Arrangement at Carrollton plant for handling truck loads, as well as car loads, of stone and sand**



Hopper and belt conveyor at Lexington plant. Transit mixer trucks are loaded beneath batching scales. Railroad tracks (not shown) are situated approximately 100 ft. from this hopper.

projects. The Clinton and Lexington plants use three 2-cu. yd. truck mixers, while the Carrollton and Richmond plants, operated by the same owner, have switched to two 3-cu. yd. and one 5-cu. yd. mixers to meet the needs of contractors.

Although there are nearby aggregate sources the plants have found that to keep needs filled, material must sometimes be shipped in from Kansas City. This means a rail haul of about 80 miles to Clinton and Carrollton,

while the shortest haul, to Lexington, is 40 miles. The demand for these aggregates has tended to open up new sources for sand and stone.

#### Sales Promotion Awards

UNIVERSAL CONCRETE PIPE Co., Columbus, Ohio, has awarded duplicate first prizes to two engineers who tied for top honors with perfect scores in a sales promotion contest, it was announced by T. H. Monaghan, general sales manager at the Columbus offices.

Sam Buderman, Wheeling, W. Va., in charge of West Virginia sales, and A. G. Cochran, Columbus, Ohio, plant sales manager, turned in the best solutions to engineering problems and questionnaires on concrete pipe and cribbing. Both of the winners are civil engineers who have been with the company for many years.



Hopper at Clinton plant has cover as protection against adverse weather conditions.

## Different... Sensational... WORK THE FIRST DAY AND THEREAFTER

\$4300.00!

HOW CAN SO LITTLE MONEY BUY SO MUCH!

**400** BLOCKS  
PER HOUR



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VAN-U-MATIC has ALL the features . . . "FINGER-TIP CONTROL" pneumatic power operation, vibration and off-bearer . . . Plain pallets ( $\frac{1}{3}$  usual pallet investment) . . . Makes all size blocks, 16" or 18" lengths, modular sizes or to your special core requirements . . . Quick easy changeover . . . True dimensional, perfect blocks . . . Compact . . . Easy to install and clean. Ask about our new 3 unit machine.

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Buffalo, N. Y.

G. W. Robertson  
Hillsdale, N. Y.  
Van-U-Matic Sales Co.  
Woodbridge, N. J.

Pumicrete Sales Co.  
Fresno, Calif.  
Northeast Con. Prod.  
Northeast, Md.

F. H. Yanks  
Chester, Pa.  
Maysville Con. Prod.  
Maysville, Ky.

Wakeman Associates  
Lakeland, Fla.  
Jacobs Con. Prod.  
Oscawatchee, Wis.

**1** Simplified, full-floating charging hopper assembly. Improved seal design assures low maintenance cost.

**5** Mixing and discharge control clutches mounted on shaft-ends for simpler, quicker adjustment or replacement.

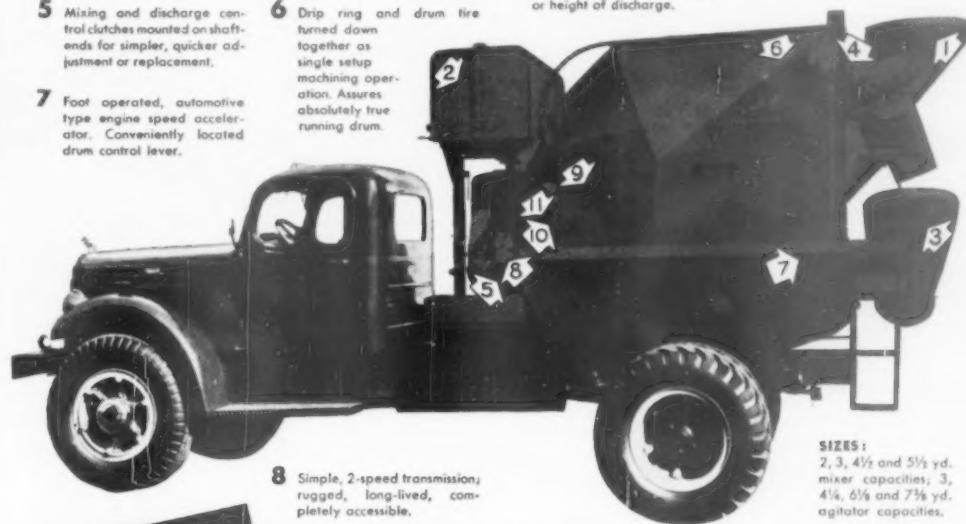
**7** Foot operated, automotive-type engine speed accelerator. Conveniently located drum control lever.

**2** Improved overflow-type water tank; non-breakable gauge glass and non-freeze valves.

**6** Drip ring and drum tire turned down together as single setup machining operation. Assures absolutely true running drum.

**3** Rigid, quick-detachable chute support bracket. Easily swung clear when discharging into hoist buckets; quickly adjustable for slope of chute or height of discharge.

**4** Renewable drip ring is quickly, easily, accurately replaced and locked on drip ring flange by 12 cap screws.



**8** Simple, 2-speed transmission; rugged, long-lived, completely accessible.

**9** Chain-driven drum reduces weight without loss of strength.

**10** Trunnion bearing design, with double race bearings for maximum flexibility.

**11** Fabricated, all-steel drum-head. Conical section with steel reinforcing ribs absorbs shocks.

**SIZES:**  
2, 3, 4½ and 5½ yd.  
mixer capacities; 3,  
4½, 6½ and 7½ yd.  
agitator capacities.

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*Our trucking foreman is particularly com-*

*plimentary of the new Hi-Up's well designed transmission system, including the transmission itself. Our shop service men are complimentary of the unit's ability to properly mix and discharge low slump concretes. We compliment you on a well engineered and well designed truck mixer.*

SOUTHERN MATERIALS CO., INC.  
J. W. Roberts, Vice President

Give the new Hi-Up's features a good going-over — one by one. You'll agree that they add up to more concrete at lower cost — and that there's more worth in a Blue Brute. For further facts, see your

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## Properties of Concrete

(Continued from page 168)

weight concretes gave compressive strengths between 70' and 2500 p.s.i. The 7-sack mixes were materially stronger ranging up to 6000 p.s.i. for expanded shale.

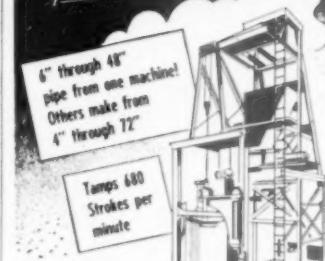
As might be expected, the porosity of the concrete was found to increase as weight decreases, ranging from 50 percent of water absorbed by volume for a 3-sack mix of vermiculite concrete (28 lb. per cu. ft.) to 7 percent for a 9-sack expanded clay (100 lb. per cu. ft.). The corresponding absorptions by weight were approximately 118 and 4 percent respectively. With very few exceptions, porosity increased with decrease in cement content. Use of air-entraining agents and increase in cement content improved durability of all concretes.

The coefficients of thermal conductivity ( $k$  values) range from 1.7 to 2.4 B.t.u./hr. ft.<sup>2</sup> (°F/in.) for the pumice concretes tested at the National Bureau of Standards as compared with values of 6.7 to 9.6 for sand and gravel concrete. Still lower  $k$ 's (0.75 to 1.6) were measured on the vermiculite and perlite concretes. These two materials represent the extreme in light weight, but have the consequent drawbacks of low strength and high porosity with related uncertainty of behavior under weathering unless protected. However, their low density and very low heat conductivity provide a great field of usefulness where strength is unimportant. The slags, expanded clay, shale and slate, sintered fly ash and pumice, are intermediate in their properties and can be used in place of conventional sand-and-gravel concrete except where extremely high strength is required. The lower thermal conductivity and lighter weight of these materials are advantages in practically all construction.

The Bureau's investigations showed, in summary, that concretes, weighing as little as one-fifth the weight of ordinary concrete, are possible using lightweight aggregates. Though these extreme lightweight concretes developed little strength, thermal conductivities as low as one-tenth that of sand-gravel concrete were exhibited. Other lightweight-aggregate concretes developed compressive strengths between 1000 and 7000 p.s.i., and weighed approximately one-third to two-thirds as much as sand-gravel concrete. Their thermal conductivities when dry were of the order of one-fourth to one-half those of ordinary dense concrete. Most lightweight aggregates had relatively high water absorption, and shrinkage of the concretes made with them was approximately two or more times that of dense aggregate concrete. Except for lean 3-bag mixes, lightweight concrete containing air-entraining agents, in general exhibited remarkable resistance to laboratory freezing and thawing tests of a rather severe nature.

## Universal

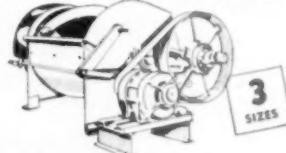
Pipe Making Machines are real profit makers because they're built by pipe makers! ... They produce more pipe in fewer man-hours... at greater profit!



## Universal Concrete Pipe Machines

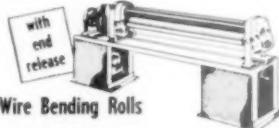
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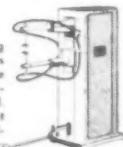
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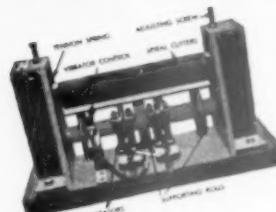
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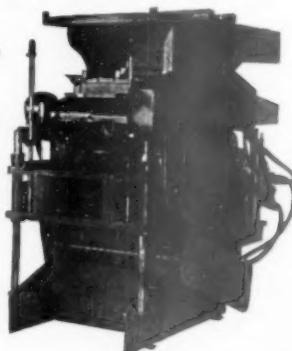
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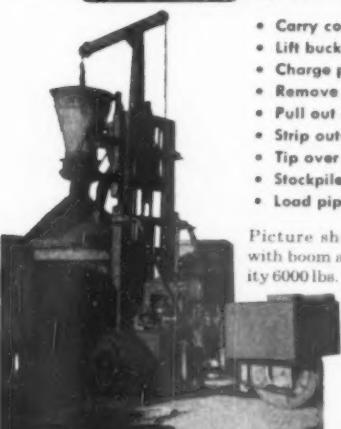


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A full equipped Modern block plant. Capacity of plant 5,000—8" block; with present machine 2,500 per day. The only plant in the city. Will consider sale of equipment only.

**J. J. YELLEN**  
381 Jeffries St. Perth Amboy, N. J.

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**CEMENT COLORS**—Write for samples and prices of "LANSO" CEMENT COLORS in bright shades of RED, YELLOW, GREEN, BLUE, BLACK, BROWN. Manufactured by

**LANDERS-SEGAL COLOR CO.**  
73 Delevan St. Brooklyn 31, N. Y.

### CONCRETE BRICK COLORS

#### CEMENT COLORS

#### MORTAR COLORS

made by

**BLUE RIDGE TALC CO., INC.**  
Henry, Virginia

**LITH-I-BLOCK**

A TWO OR THREE-BLOCK PLAIN  
PALLET AUTOMATIC MACHINE

FEW MOVING PARTS — LOW MAIN-  
TENANCE — DEPENDABLE OUTPUT OF  
8 OR 12 PRECISION BLOCK PER MINUTE

*White*

LITH-I-BAR COMPANY  
HOLLAND, MICH. DEPT. CP-2

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**CONTINUOUS  
MIXER**

*Streamlining YOUR  
CONCRETE BLOCK MANUFACTURING*

More production and larger profits are yours when you install the Eclipse Continuous Mixer. This mixer is the ideal companion to the Eclipse Concrete Block Machine and the Eclipse Power Tamper. Easily loaded, quick uniform mixing, positive geared discharge. The paddles are attached to a square shaft assuring positive, trouble free operation. Paddle shaft easily removed for cleaning. Well constructed for longer life.

WRITE OR WIRE FOR FURTHER INFORMATION

MANUFACTURED BY  
**GEO. C. CHRISTOPHER & SON IRON WORKS**  
FOR FORTY YEARS THE WORLD'S BEST IN CONCRETE MACHINES  
P. O. BOX 610 WICHITA, KANSAS

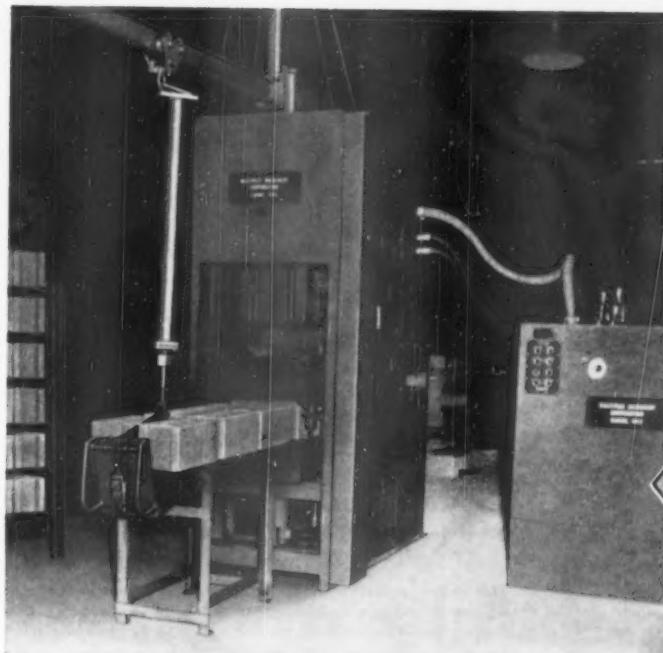
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LEADING BLOCK MANUFACTURERS prefer

# MULTICO AUTOMATIC



## BLOCK MACHINES

COMPLETELY AUTOMATIC

HANDLES ALL AGGREGATES

PRESSURE VIBRATION PLUS TAMPING

SEPARATE POWER PAK CONTROL CABINET

MAKES ALL SIZES & SHAPES OF BLOCKS

**Exclusive! – Only Multico gives you  
Vibration, tamping and pressure!**

The Multico is industry's most versatile block machine. It makes all sizes and shapes of blocks, thus you can fill all orders—faster. Its practically a factory in itself. The Multico takes the aggregate and tamps on pressure while vibrating—all fully automatically, *all in one operation*—no other block machine can do this. Its exclusively MULTICO. Once the controls are set the MULTICO needs no operator excepting, of course, the offbearer. Thus you cut down on overhead, cut down on labor, and produce finer quality blocks faster.

Not a special machine, but a simple rugged

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## MULTIPLEX MACHINERY CORP.

ELMORE  
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**MULTICO**  
BLOCK MACHINES

MFGRS. of BLOCK MACHINES • MIXERS  
SKIP HOISTS • STRIPPERS and ELEVATORS



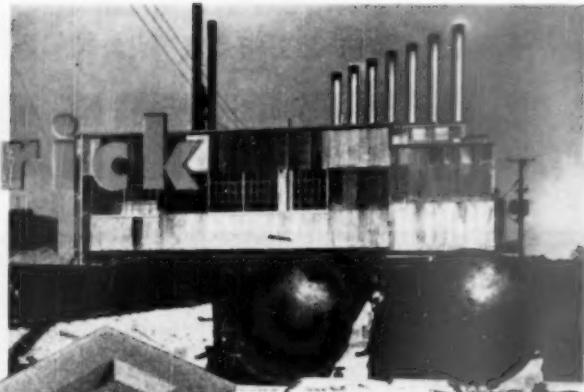
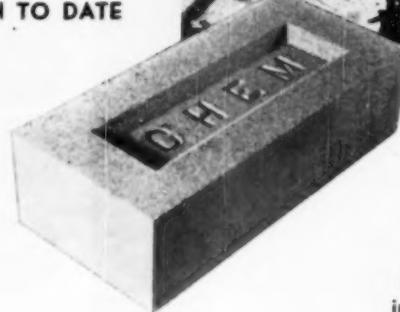
## AT LAST!

# chem brick

## A FACE BRICK OF HIGHEST QUALITY—

MADE WITH THE CHEAPEST  
MATERIALS KNOWN TO DATE

"CHEM BRICK" requires no cement or commercial lime . . . is made only with sand and waste materials.



Detroit Brick & Block Company, first licensee by Jackson & Church Company to manufacture "CHEM BRICK".

### "CHEM BRICK" . . .

the sensational, new building material . . . passes the A.S.T.M. specifications for first quality face brick and the most exacting freezing and thawing tests . . . yet no ingredient costs more than \$2 per ton, including binder.

A REAL HIGH QUALITY FACE BRICK WHICH CAN BE MADE CHEAPER THAN ANY COMMON BRICK ON THE MARKET TODAY

This quality product . . . made by the cheapest process in the brick industry is finding a ready market in the Detroit area where it has brought usually expensive brick veneering within the reach of average purses. In addition to its low cost other features are its distinctive finish, color and uniformity which give any building that "quality appearance" when used as a facing material.

Besides being a fine face brick . . . "CHEM BRICK" is an all-purpose brick because of its low cost of manufacturing. Can be used anywhere brick is used . . . facing, back-ups, partitions, manholes, fire places, chimneys, basement walls, etc.

Boxed at left are excerpts from test reports on "CHEM BRICK" made by Pittsburgh Testing Laboratory. Note distinctive appearance of home pictured utilizing "CHEM BRICK" as facing material.

**PITTSBURGH TESTING LABORATORY**  
AN INSTITUTE OF  
PITTSBURGH, PA.

April 13, 1949

**REPORT**  
**TESTS OF FRESH BRICK**  
**MANUFACTURED BY**  
**DETROIT BRICK & BLOCK CO.**

---

**CONSTITUTION**  
(6 Brick - Coated Flat-sides)

No. of samples 100 Average 4.00  
5 Average 4.00

**REGULAR TESTS**

No. of samples 100 Average 97.5  
5 Average 97.5

**ABRASION**  
(1/4 hour immersion in 6 Brick)

No. of samples 100 Average 1.14  
5 Average 1.14

All samples submitted by Detroit Brick & Block Co.

**PITTSBURGH TESTING LABORATORY**  
*E. W. Stevenson*  
**DETROIT, MICHIGAN**

---

April 13, 1949

**REPORT - FRESH & DRYING**

**METHOD OF TEST -** Aut. T.M. Designation: 67-44  
covering the Standard Methods of  
Testing Building Materials for  
a total of 33 articles.

**TESTS CONDUCTED -** Test indicated compliance with specific  
listing requirements for freezing and thawing test.

Respectfully submitted,  
PITTSBURGH TESTING LABORATORY

*Frank G. Cole*  
Frank G. Cole  
DETROIT, MICHIGAN

**JACKSON & CHURCH COMPANY**  
**SAGINAW, MICHIGAN**

"WORK WELL DONE SINCE '81"



Typical new home construction using "CHEM BRICK" as face brick.  
Detroit, Michigan.



# 10 Years, 24 Hours a Day, Grinding Clinker and Slag

TEN YEARS AGO this three compartment *Compeb* mill was installed in the Pennsylvania plant of a large cement manufacturer for finish grinding cement.

The mill has been in continuous operation ever since, grinding cement clinker and blast furnace slag to a product of 2400 specific surface. The most recent inspection indicated that this mill would be good for many more years of service.

The plant's operators are pleased—report a well-graded, uniform product is obtained with very low maintenance.

**4 REASONS WHY CEMENT MEN INVEST IN A-C MILLS**

- Wide selection — Allis-Chalmers

*Compeb* and *Texrope* are Allis-Chalmers trademarks.

builds five separate types of grinding mills in a maximum range of sizes. That means you'll get the right type and size mill for your specific job... Better efficiency and economy!

- "Stress-relieved" — All-welded mill shells are put through an annealing process that eliminates strains . . . makes a better mill.
- Long bearing life — Extra large bearings mean low bearing pressure.
- Unsurpassed experience—and manufacturing facilities! Allis-Chalmers has built over 4,000 grinding mills. Call on A-C's wide experience next time you have a grinding problem. There is an Allis-Chalmers office in your area.

A-2915

IT PAYS TO SPECIFY MOTORS...  
CONTROLS...V-BELT DRIVES—ALL  
FROM ALLIS-CHALMERS



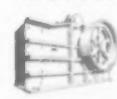
Motors — Controls



Texrope Drives



Vibrating Screens



Jaw Crushers



Kilns, Coolers, Dryers



Gyratory Crushers

# ALLIS-CHALMERS

Sales Offices in Principal Cities in the U.S.A. Distributors Located Throughout the World.



# You Can't Beat Welded Construction

## WELLMAN Williams Type BUCKETS

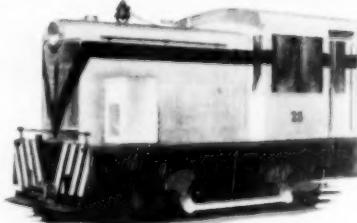
Wellman pioneered welded rolled steel construction for longer life and greater service. It's the extra strength that gives the extra, low-cost digging power. Whatever your requirements . . . whether for Multiple Rope, Power Arm, Dragline, Power Wheel or Special Service—specify Wellman!  $\frac{3}{4}$  to  $16\frac{1}{2}$  Yd. capacity.

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THE WELLMAN ENGINEERING COMPANY  
2025 CENTRAL AVENUE • CLEVELAND 4, OHIO

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DAVENPORTS  
are AVAILABLE  
in STEAM  
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or  
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DRIVE  
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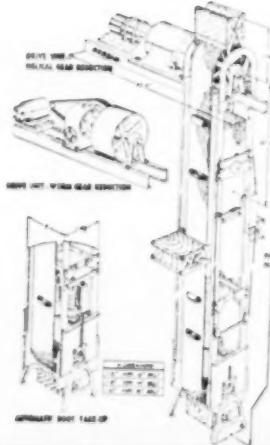


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A DIVISION OF DAVENPORT BESSLER CORP.  
DAVENPORT, IOWA, U. S. A.

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Cable Address "BROSITES"

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EMPLOYEES  
ELEVATOR  
makes you  
MONEY



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Ehrsam Employees Service Elevator is made for 3 widths of belt, 12", 14" and 16" with three types of drive units of either 3, 5 or  $7\frac{1}{2}$  horsepower. Special applications for bags and boxes. Installation costs are reasonable. Write today for complete information.

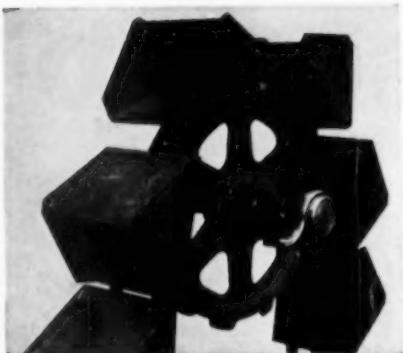
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Manufacturing Co.

ENTERPRISE,

Established 1872

KANSAS U.S.A.





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Our stock is large—can ship most sizes and types from stock  
ALL TYPES OF ELEVATORS

TRIANGLE ENGINEERING COMPANY

2950 West 26th Street, Chicago 23, Illinois

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**WOVEN WIRE SCREENS**  
ACCURATE • DURABLE • ECONOMICAL

The reliability of T.C. Alloy Screens has carried them into all parts of the world. Made in Standard and Special Weaves, with Square or Oblong Openings — from 10 mesh, .035" wire on up. Write today for Catalog No. 42.

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WON'T QUIT  
OR CAUSE TIME OUT  
A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

THE HAYWARD COMPANY  
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**PERFORATED METAL**  
SAND AND GRAVEL SCREENS  
Manufactured exactly to your specifications  
Any size or style screen, in thickness of steel wanted with any size perforation desired.  
We can promptly duplicate your present screens at lowest prices

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Continuous operation without attention.  
Individual engineering on every application. Heavy pumping parts of rubber,  
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1775 Broadway, New York City

**THE "Quinn Standard" FOR CONCRETE PIPE**

The Quinn Standard is known as the best the world over, wherever concrete pipe is produced and used. Backed by over 35 years service in the hands of hundreds of Quinn-educated contractors, municipal departments and plant manufacturers who have learned to appreciate Quinn pipe forms and Quinn mixing formulas combine to produce the finest concrete pipe of lowest cost.

**QUINN HEAVY DUTY PIPE FORMS**  
For making pipe by hand methods, lay either the wet or semi-dry processes. Built to give more years of service—sizes for pipe from 10" up to 120" and larger—tongue and groove or bell end pipe at lowest cost.

**WRITE TODAY.** Complete information, prices, and estimates sent on request.  
Also manufactures QUINN CONCRETE PIPE MACHINES

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**CONCRETE BURIAL VAULTS**  
AMERICA'S FINEST MOLDS AND LOWERING DEVICES

**BERG VAULT SYSTEM**  
TERRITORY FRANCHISES  
BERG VAULT CO.  
EQUIPMENT DIVISION  
1620 LUCAS HUNT RD., ELLIOTTWOOD, PA.

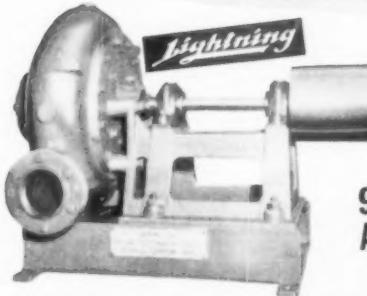


**HEAVY DUTY MULTI-WALL  
SHIPPING  
SACKS**  
OPEN-MOUTH  
VALVE-TYPE  
PASTED AND SEWN  
Including Flat Tube Valve Bags

630 FIFTH AVE., NEW YORK 20, N.Y.  
MILLS AT GILMAN, VT.

**KRAFT  
BAG  
CORPORATION**

**DELIVERS MORE AT  
LOWER COST!**



**9 YARDS  
AN HOUR**  
From 3 and 4  
inch sizes

These heavy duty Lightning 3- and 4-inch pumps really do a job for the smaller operator. They pass solids up to 2½-in. diameter and fit easily into limited space. Built to take severe punishment, Lightning pumps have side plate liners and can be completely torn down with ordinary tools.

Write today for complete information.

The **Lightning**  
**SAND & GRAVEL PUMPS**

**KANSAS CITY HAY PRESS CO.**  
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**4 DAYS' FOOTAGE  
DRILLED IN 3**  
with JAEGER "air-plus" pressure

Old compressor ratings, set in 1932, underpower today's tools. Jaeger gives you the air you need to maintain steady 90 lbs. pressure in a full set of tools, make tools hit harder and faster, do 30% to 40% more work in the same number of hours. Ask your Jaeger distributor.

**THE JAEGER MACHINE COMPANY**  
Columbus 16, Ohio

Sales, Rentals and Service in 130 Cities of United States and Canada

PUMPS • MIXERS • HOISTS • PAVING EQUIPMENT

**HOW TO REEVE THE BUCKET  
FOR MAXIMUM EFFICIENCY**



CORRECT reeving of your bucket is essential for maximum digging efficiency and proper speed of operation. Complete instructions for proper reeving to fit every job are included in Bulletin 2230-R. You will also get a wealth of

information about lubrication, lengthening cable life, repairing worn parts and operating information that mean increased efficiency. Just ask for Bulletin 2230-R.

**BLAW-KNOX DIVISION**  
of Blaw-Knox Company

2025 Farmers Bank Bldg. • Pittsburgh 22, Pa.



**BLAW-KNOX CLAMSHELL  
BUCKETS**  
THE MOST COMPLETE RANGE OF SIZES AND TYPES

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If you haven't yet installed a Payroll Savings Plan in your company, you can be pretty sure some of your employees are asking that question. For workers *like* this easy, automatic way of investing in U. S. Savings Bonds—and more than 20,000 large companies have made this convenience available to the people on their payrolls.

## WHAT GOOD IS "PAYROLL SAVINGS"?

The Payroll Savings Plan is the *only* means by which people can obtain Bonds automatically on the installment plan. It pays off in many ways: increased security for the individual, who gets back \$1 for every \$3 when the Bonds mature; company benefits due to improved worker morale—a reduction of absenteeism, labor turnover, and accidents; increased national security, because Bond sales spread the national debt.

## HOW MANY CAN AFFORD BONDS?

Deductions for taxes and other purposes which reduce take-home pay should not be confused with allotments for Bonds, which are taken home as *interest-paying savings*. Of course, the cost of living makes it tough for some people to buy Bonds. But nation-wide experience indicates that 40-60% of the employees in any company can be persuaded to sign up for Payroll Savings—without high-pressure selling.

7,500,000 workers are regularly buying an individual average of \$20 of Savings Bonds per month. Show your employees that you want them to have the convenience of Payroll Savings. You'll find it easy to set up the Plan in your company. All the materials and assistance you need are available from your State Director, U. S. Treasury Dept., Savings Bonds Division. (See your phone book.) Why not talk it over with him now?

*The Treasury Department acknowledges with appreciation the publication of this message by*

## Rock Products



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## FOR SALE

**SHIPMENT FROM STOCK**

- 3- No. 14 Sanderson Cyclone Well Drills.
- 1- Howe Track Scale 83 ft. long 150 ton capacity
- 1- 10" Newhouse Crusher.
- 1- 350 HP Allis Chalmers Engine, Type 1000, 4 cylinder, 2 phase, 25 cycle, 480 volt, 438 KVA, 1000 P.F., 500 RPM.
- 2- 100 HP Allis Chalmers Slip Ring Motors, Type AYH, 3 phase, 60 cycle, 440 volt, 580 RPM.
- 2- 15 HP Allis Chalmers Slip Ring Motors, Type AYH, 3 phase, 60 cycle, 440 volt, 1730 RPM.
- 1- 2 HP Master Geared Head Motor, Type PA, 3 phase, 60 cycle, 440 volt, 575 RPM.
- 1- 175 HP Ideal Induction Type Motor AV, 3 phase, 60 cycle, 440 volt.
- 1- 75 HP Westinghouse Motor, 3 phase, 60 cycle, 440 volt.
- 1- 50 HP GE. Motor, Type MF 336, 3 phase, 60 cycle, 440 volt.
- 1- 50 HP Pan Electric Motor, 3 phase, 60 cycle, 440 volt.
- 1- Allis Chalmers 4 $\frac{1}{2}$ "x4" Electric Pump complete with 16 HP, 3 phase, 60 cycle, 440 volt motor.
- 1- Gould 1 $\frac{1}{2}$ "x1" Electric Pump, Fig 3640, complete with  $\frac{1}{2}$  HP, 3 phase, 440 volt motor, 60 cycle.
- 1- Koper 2 $\frac{1}{2}$ " Electric Rotary Pump complete with 5 HP, 3 phase, 60 cycle, 440 volt motor.
- 2- Two deck 36"x60" Hummer Screens
- 1- Ten Ton Plymouth Standard Gauge Locomotive with Ford V 8 engine.
- 1- S.A. No. 200001 Speed Reducer.
- 1- 6" Maxim Silencer.
- 2- Sullivan TM 360 Drift Drills
- 2- Sullivan Type MV 6 Drill Wagons.
- 1- International Power Unit, 6 cylinder UDR 760, Diesel.
- 1- Complete Cleveland Wagon Drill.
- 1- D-7 Caterpillar Tractor complete with Cable Controlled Dozer

**COLUMBIA QUARRY CO.**  
1007 Washington Ave., St. Louis 1, Mo.

**GYROTHY** "30", "36", "42" and "48" Allis-Chalmers, nos 12, 10, 8, 7, 6, 5 and 4. **JAW TYPE** 24400, 25500, 22550, 30824, 40424 **JOHN DEERE** smaller sizes. **KENYON** **REDUCTION TYPE** "3", "4" and "5" ft. Symons Cone Nos. 15, 25, 37 and 38 Kennedy "30" Traynor "22", "18" and "14" TF No. 30 Telmex Girard "14", "18" Newhouse, Steelman "30" and "26" Impact. **ROLLER** Allis-Chalmers 72250, 52400, 54400, 49400, 45400, 41400, 37400, 33400, 29400, 25400, 21400, 17400, 13400, 10400, 6400, 5000, 4600, 4200, 3800, 3400, 3000, 2600, 2200, 1800, 1400, 1000, 600, 500, 400, 350, 300, 250, 200, 160, 120, 100, 80, 60, 50, 40, 30, 20, 15, 10, 8, 6, 5 and 4. **HOLMAN** 34160 and 16161. **McLanahan** 30" and "18" 14 and 18200 Single Roll. 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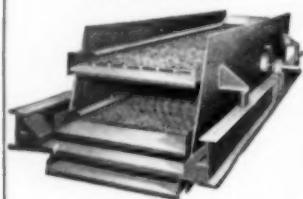
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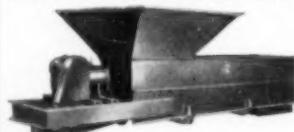


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Harrington 10" x 16" jaw crusher  
Chambers No. 4 9"x12" jaw crusher  
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100' of 24" belt conveyor, roller bearings  
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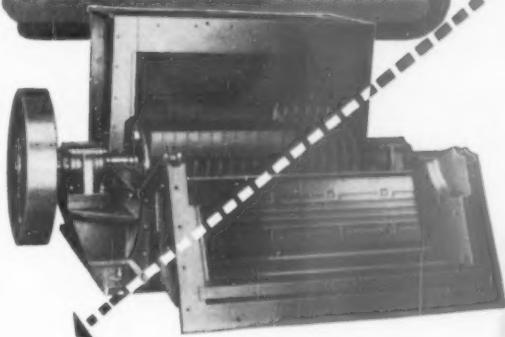
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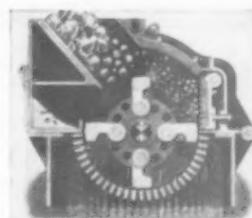
## For Cost Reduction on Material Reduction...



## WILLIAMS' "HEAVY-DUTY" HAMMERMILLS

Built to take 6" feed and reduce to agricultural limestone,  $\frac{3}{4}$ " stone and other small sizes in one operation! Crushing occurs on unusually heavy breaker and grinding plate before reaching grate. This permits grates to be used for sizing only, minimizing wear. The result: more output, more quickly reduced at less operating cost.

Sectional view of Williams "Heavy-Duty" hammermill, with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.



### WILLIAMS ALSO MAKES...

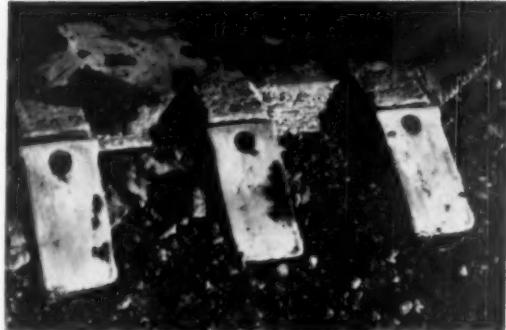
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WEAR-E



# service life increased 5000% with **AMSCO® Hardfacing!**



**Post Hole Digger now digs 206 holes  
in rocky soil before repointing**

Just 4 holes was the former life of a new point and blade on this power-driven post hole digger. After hardfacing with AMSCO Tube Tungsite, the same blade and point dug 206 holes—*51 times the former service!*

**Here's another example of big savings  
with AMSCO Hardfacing . . .**

Lips and teeth of this dipper were given far greater resistance to impact and abrasion with AMSCO Economy Hardface . . . resulting in longer dipper life, lower handling costs per ton.

These are typical examples of tremendous savings made with AMSCO Hardfacing . . . savings in time, maintenance and money! Wherever *any kind of part*—from huge mining dippers to small drill bits—is subjected to impact or abrasion, you'll find that it pays to hardface with AMSCO Welding Products.

#### **Where to look for money-saving hardfacing applications:**

On parts subject to wear by abrasion, impact, heat or corrosion, such as:

Earthmoving Equipment • Farm Equipment  
Oil Field Drill Bits • Sprockets • Dredge  
Pump Shells • Materials Handling Equipment  
• Pulverizer Hammers • Punching,  
Trimming, Forging Dies • Coal Cutter Bits.

*put LIFE into service with*

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# Dual Impact Action...

From "revolutionary" new principle  
...to outstanding success  
—in 4 production years



**BASIC IDEA:** Double impellers rotate in opposite directions at speeds of 250 to 1000 r.p.m. Material to be reduced gets first impact while still in midair; is driven against bars, again and again. Breaker bars are so rounded that stone glances off immediately. Size is controlled by impeller speeds, by spacing of vertically and horizontally adjustable bars.

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**BRILLIANT SUCCESS:** Today's New Holland Double Impeller Breaker is used, endorsed by operators working in limestone, slag, carbon, copper, lead-zinc, gypsum, talc, gravel, perlite, basalt, other kinds of rock. Model 5050 (illustrated) takes 50" rock, up to 400 tons per hour; reduces it to -4". Lined with 2" manganese steel plates. Self-aligning heavy-duty anti-friction bearings. Minimum h.p. required. Mounted on heavy I-beams for easy installation. Available models: 1212, 2020, 3030, and 5050. Write for information—literature, location of nearest installation. Address Department R-20.



**NEW HOLLAND DOUBLE IMPELLER BREAKERS**

NEW HOLLAND MANUFACTURING COMPANY, MOUNTVILLE, PA.

Affiliate of The Sperry Corp



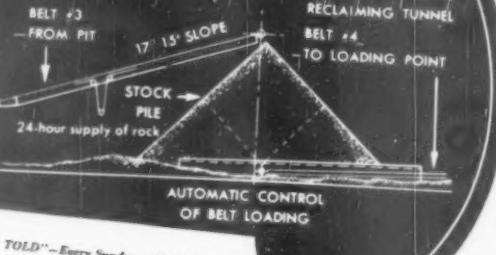
## These belts outwork 6 trains!

In a Virginia quarry, a system of four Goodyear conveyor belts—one of which you see here—carries limestone that six donkey-engined trains used to carry laboriously from quarry to plant. The conveyor system, designed by the G.T.M.—Goodyear Technical Man—is  $\frac{1}{4}$ -mile long, instead of the six miles of track the railway system used. In addition to short-line haulage, the belts have larger ton-per-hour capacity, making stock piling at the processing end easier. Constant flow ends spotty loading. Haulage costs are far lower, too.

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